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POPULAR SCIENCE MONTHLY
SUMNER N. BLOSSOM, Editor
May, 1925

Giant Engines Point to New Era in Transportation

A story of the remarkable struggle between steam, electricity, and oil—Marvelous inventions may mean cheaper travel by rail and sea

By Hawthorne Daniel

DEVELOPMENTS in transportation during the last few months all seem to point to the ultimate subordination or elimination of steam as a direct source of power for the movement of ships and trains.

Significant of this trend was the recent arrival from Great Britain of the motor-ship *Aorangi* at the Panama Canal and later at San Francisco, and the keen interest of American engineers in this beautiful 23,000-ton passenger liner driven by internal combustion engines. Likewise, the activity of the U. S. Shipping Board in installing Diesel engines in ships that formerly were equipped with steam, has created widespread comment.

Among other signs that have led engineers to ask seriously whether the day of steam is passing is the announcement of Samuel M. Vauclain, president of the Baldwin Locomotive Works, that his company is experimenting with a locomotive driven by electricity generated by a Diesel engine.

The announcement of the Pennsylvania Railroad that contracts have been let to electrify the main line of that road between New York and Washington, and the announcement of the New York, New Haven & Hartford Railroad that more of its branch lines are being electrified.

What is happening in the field of transportation? What tendencies are apparent just now, and how will they affect steam?

Modern transportation came into existence as a result of the discovery of the power of steam, and for 100 years it was the development of steam engines that made possible the development of transportation.

Twenty years ago steam had just about completed the task of running sailing-ships from the sea; and ashore, except for street railways and a few wheezy automobiles, steam was practically supreme as a source of power for transportation.

Recently, however, Lloyd's—that great marine insurance organization that compiles most of the world's nautical data—has announced that more than one-third of the total ship tonnage now being built will be motor-driven. And reports come from railroads all over the world—from India, Spain, Britain, Switzerland, America and elsewhere—that electricity and other sources of power are making serious inroads against steam.

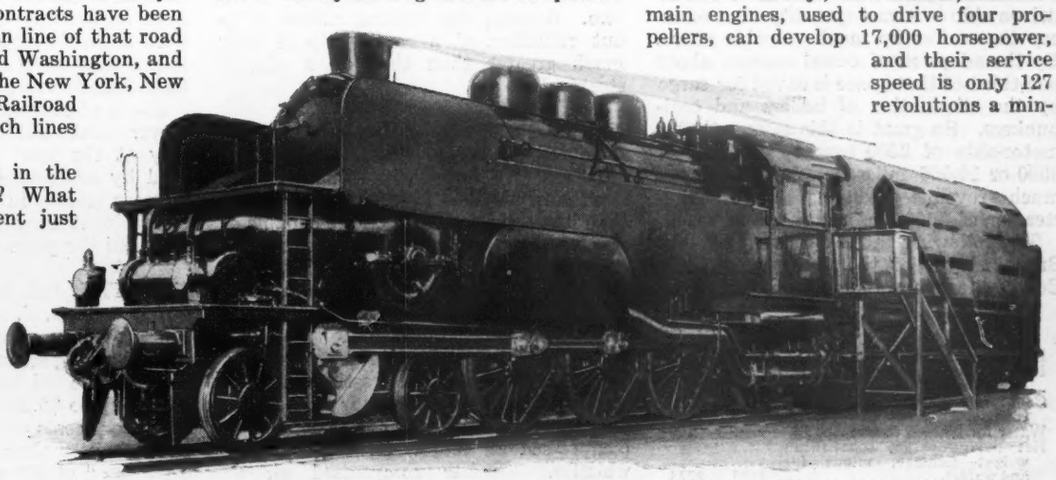
Let us see first what is happening at sea before we turn our attention to the railroads.

The first ocean-going passenger ship propelled by Diesel engines was the East Asiatic Company's *Selandia*, built in 1911. She is capable of 12 knots and has a dead-weight cargo capacity of 7400 tons. Today the largest and most powerful of these new ships actually in operation is the newcomer in the Pacific—the Union Steamship Company's passenger liner *Aorangi*—a ship of 23,000 tons displacement and a speed of eighteen knots. Yet so rapid is the development of ships of this type that within the year the *Aorangi* will be surpassed by no less than six Diesel-driven ships that now are being built.

TO UNDERSTAND thoroughly the motor-ship and its ability to compete so successfully with steamships, you first must eliminate definitely any connection between a motor-ship and a motor-boat. They are no more alike than a great Mogul locomotive and a steam-driven automobile.

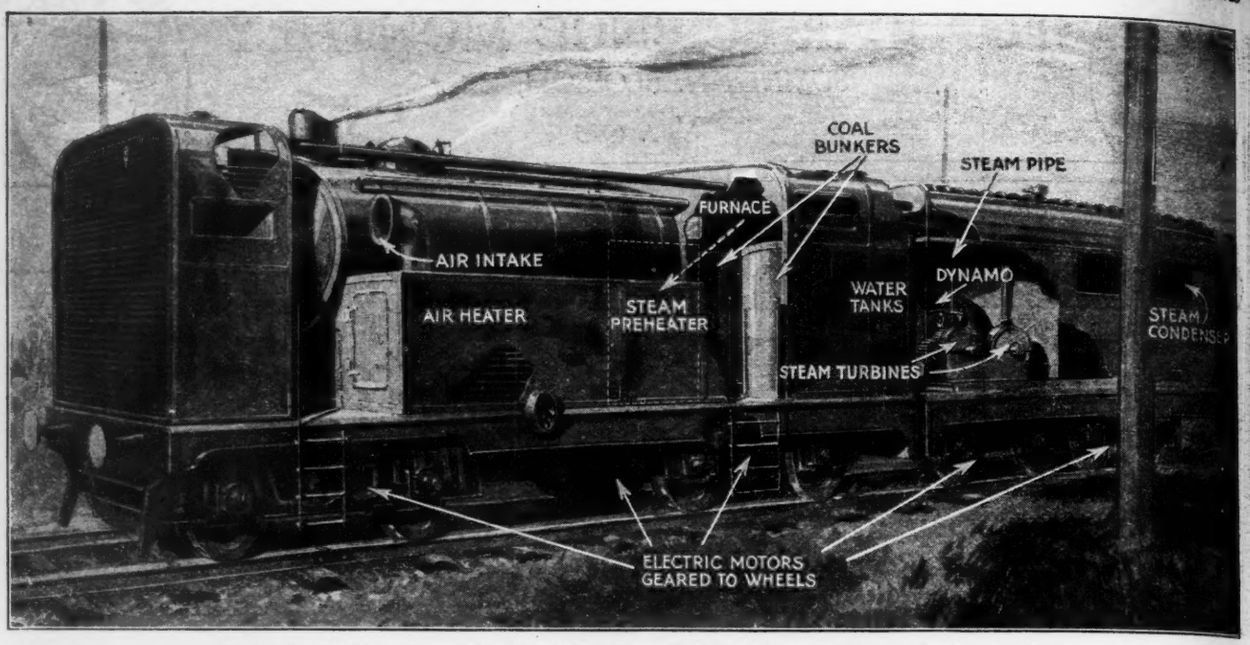
A motor-boat is propelled by one or more gasoline engines, exactly the same in principle as the motor that drives your car. The motor that drives the motor-ship, on the other hand, is different in design, principle, size, and power.

On the *Aorangi*, for instance, the four main engines, used to drive four propellers, can develop 17,000 horsepower, and their service speed is only 127 revolutions a min-



Will This Monster Stem the Tide away from Steam?

One of the most extraordinary of the new developments in locomotives is this odd-looking steam-turbine engine of 2000 horsepower, recently built at the Krupp works in Germany. It is reported to develop greatly increased hauling power with a 20 per cent saving in fuel over the ordinary reciprocating type of locomotive still in use on most of our railways



Electric Drive Combined with Steam Turbine Is French Invention

Millions of tons of coal might be saved to our railroads annually, it is claimed, if the present reciprocating engines were replaced by this type of turbo-electric locomotive recently invented by M. Leon Metais, a French engineer. The chief features of this new locomotive are a steam-generating plant and a pair of steam turbines that drive a 2500-horsepower dynamo for generating electric current. This current, in turn, drives electric motors coupled to the wheel axles. Exhaust steam from the turbines is carried to a condenser, converted into water, and used over again in the boiler. The turbo-electric engine is said to ultilize as much as 25 per cent of the heat developed from fuel combustion, as compared with only about six per cent for the reciprocating type. Since the turbines could be kept running for weeks, the inventor claims, the locomotive could travel far

ute. Automobile motors are all high-speed machines in comparison with these great engines, and many automobile motors turn over at speeds more than 10 times as great.

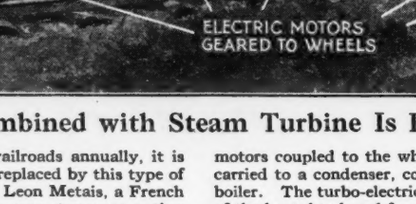
THE fuel of the motor-ship is heavy oil, which is much less expensive than gasoline. Therein lies a great advantage, for even though gasoline engines could be built of sufficient power to propel so great a weight as 23,000 tons, the cost of the fuel alone would eliminate any possibility of successful competition against steam. With fuel at about two dollars a barrel, however, instead of 10 or more cents a gallon, and with the economical power thus generated, the Diesel-engined ship begins with a very great advantage.

But the advantages do not end there. Stowed away in the hull of a steam-driven ship is a vast quantity of machinery that takes up much valuable space. By the adoption of Diesel engines about one-third of that space is saved for cargo by the elimination of boilers and coal-bunkers. So great is this saving that a motor-ship of 3500 tons, on a voyage of 8000 or 10,000 miles, can carry nearly as much revenue-producing cargo as a steamer of 5000 tons and the same speed.

The following table, prepared by Mr. Bruce Lloyd, of the Emergency Fleet Corporation, shows this advantage:

	Motor-Ship	Steam-ship
Dead-weight tonnage	3500	5000
Fuel oil for 45 days at 5 tons a day, tons	225	....
Coal for 45 days at 45 tons a day, tons	....	1125
Water for boilers, tons	....	100
Net paying cargo, tons (dead-weight tonnage, minus fuel and water)	3275	3775

A motor-ship, then, can do the work of a considerably larger steamship. While motor-ships cost more to build *a ton*,



The Turbo-Electric Drive

Diagram showing the operating principles of the turbo-electric locomotive. The arrows indicate the direction of the steam and water circuit

their cargo capacity a ton is greater, and so, consequently, is their earning power.

Still other advantages are to be found on the side of the motor-ship. First, her crew is smaller. Stokers are eliminated entirely, or in the case of motor-ships that use steam for auxiliary purposes, the number of stokers is reduced to one or two. Second, the cruising radius, without refueling, of a motor-ship is very much greater than that of a similar steamship.

IN THE case of the *Aorangi* it is estimated at 16,000 miles, which is as great as five trips across the Atlantic from New York to Liverpool. It is true that steamships burning oil are capable of much greater voyages than those burning coal, but even over these, which are the most advanced steamships, the motor-ship has a commanding lead so far as cruising radius is concerned.

The use of Diesel engines in ships has brought about many interesting developments. Without boilers for generating steam, motor-ships have had to depend on compressed air and electricity for their whistles. Either compressed air or electricity can create readily the sound that is necessary, but in crowded harbors where many ships are in motion, it is most desirable that there be a visible as well as an aural signal. Otherwise pilots have difficulty in knowing positively which ship is signaling. To offset this difficulty a "visible air whistle" has been developed. This apparatus creates its sound by using compressed air instead of steam and, at the same time, the whistle emits a cloud of white smoke by atomizing a small amount of "smoke liquid" from a tank connected with the whistle.

Where Diesel engines are used, funnels can be dispensed with, but so accustomed have we grown to the sight of them on ships that many Diesel-driven ships erect them, then utilize them for ventilation, for exhaust pipes, air-compression tanks, and other things that might readily be placed elsewhere. Below decks, however, the space given to funnels on steamships is saved. Occasionally motor-ships are to be seen without funnels, but more than once such ships have been approached with offers of assistance by those who surmised that some catastrophe had swept their funnels overboard.

Ships, of course, will be driven by the power that will do the work necessary at the least cost. If the fuel oil used by oil-burning steamships were to increase greatly in price, it is practically certain that they would revert to coal, provided the price of coal did not go up.

"WITH coal at its current price," said A. V. Moore, of Moore and McCormack, a company that is changing six oil-burning steamers into coal burners, "we can use oil economically under our boilers up to $9.80 a ton." Oil, then, at $10 a ton, costs more for fuel when used under boilers than coal at five dollars, whereas oil at $29 a ton will do as much work a dollar in Diesel engines as coal at five dollars will do under boilers. Any probable increase in the price of oil, therefore, is not likely to make motor-

ships unable to compete with coal-burning ships.

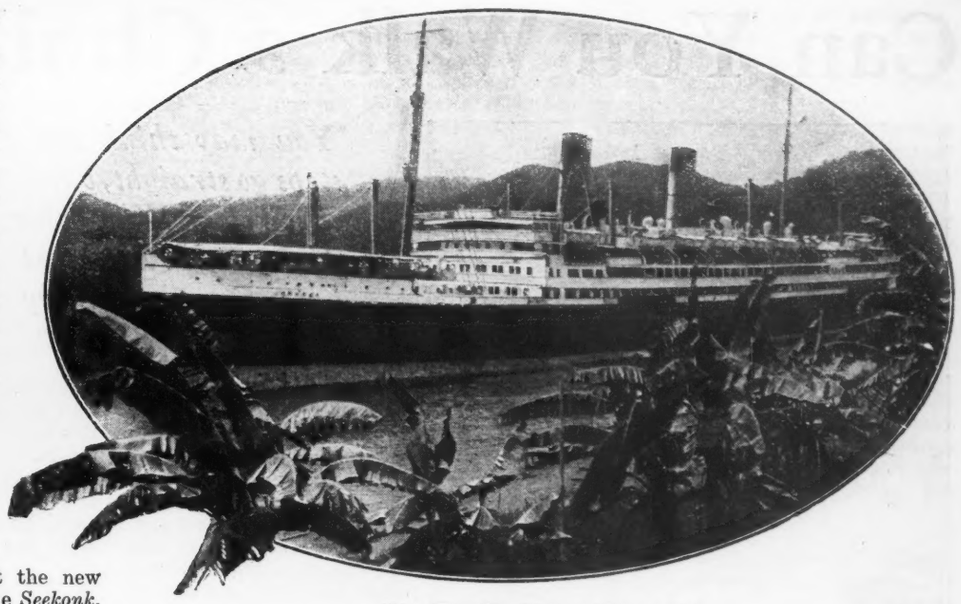
It is true that motor-ships cost about 20 per cent more to build than do steam-driven ships, although that is partly offset by the fact that motor-ships carry upward of 10 per cent more freight, have smaller crews, and can make a little better speed with the same power.

According to the United American Lines, operators of the freighter *Seekonk*, which has been converted from an oil-burning steamer into a Diesel-driven ship, the possible operating economies amount to $148,902 a year. Of this saving $67,148 is a saving in fuel. The following table, which has been verified by the United American Lines, shows some of the advantages that the new engine equipment has given the *Seekonk*.

	As Steamer	As Motor-Ship
Sea speed (loaded)	10.3 knots	10.5 knots
Daily fuel consumption at sea	29 tons	7½ tons
Daily fuel consumption in port	6½ tons	⅓ ton
Daily fuel cost at sea	$355.25	$110.25
Daily fuel cost in port	79.62	4.83
Number of engine-room crew	16 men	9 men
Wages of engine-room crew (year)	$19,520	$14,588
Yearly fuel cost, figuring 240 days at sea and 125 days in port	$95,212	$28,064

THE higher first cost of Diesel-driven ships is their greatest present handicap. Were it not for this, it would seem that practically no steam-driven ships would be under construction today. And with the great increase in the demand for Diesel engines it is not unlikely that the difference in cost between them and steam-power plants will grow steadily less.

Already many steamships are being converted into motor-ships. Twenty-three ships belonging to the U. S. Shipping Board and to several American companies already are scheduled for conversion, and abroad new motor-ships are being built and steamships are being converted more rapidly than the work is being done in America.



The World's Finest Motor-Ship

The 23,000-ton motor-ship *Aorangi*, largest and speediest motor passenger vessel in the world, passing through the Panama Canal on her recent successful 16,000-mile maiden voyage from Southampton, England, to San Francisco and Vancouver. She will operate on the route between Vancouver and Australia. This huge liner is 600 feet long, accommodates 1000 passengers, and carries a crew of 330. Power is supplied by four Diesel engines developing 17,000 horsepower. Her service speed is 18 knots and her cruising radius at full speed, 16,000 miles

It looks as if steamships have met their masters.

But what about locomotives?

Coal-burning locomotives long have been recognized as wasteful machines. They burn coal while standing around idle. They waste coal while under way. They pull tons of it in their tenders so that they may have enough to eat (and waste). Not content with that, they haul tons more in great gondola cars in order that they may stock great coal piles from which they may draw their daily rations.

And every ton of such coal that is hauled eliminates a ton of revenue-producing freight that the locomotive otherwise could be hauling.

As I have said, the New York, New Haven & Hartford Railroad long has been a user of electricity, and right now is electrifying more of its branch lines.

In India the railroads in the vicinity of Bombay are planning electrification. In Switzerland electric locomotives long have been common. Even in Spain electrification is beginning.

Whenever an electric locomotive is idle, it is wasting no power and no coal. The power house generates only what is necessary for the work being done, and should there be a period during which less power is needed, it is simple to generate less power. The steam locomotive cannot do that.

HOW often have you seen railroad yards seemingly filled with locomotives puffing, smoking, burning coal, and doing nothing? And how often have you seen locomotives roar past, showering the whole right of way (and much of the country besides) with their half burned cinders?

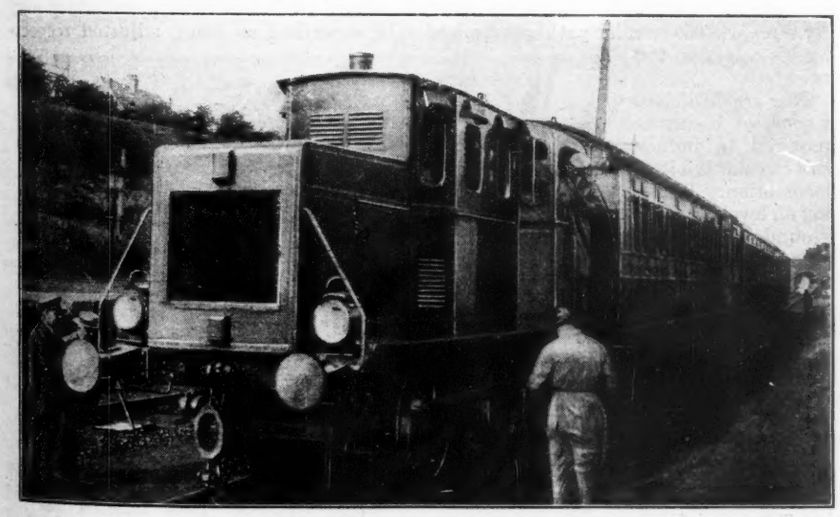
Where electricity is used, savings arise from diminished fuel consumption, from the elimination of water and coal stations with their attendants, and from greatly reduced repairs on motive power.

More and more electric locomotives will take the place of steam. Perhaps our children's children will look at pictures of our wasteful steam locomotives with much the same curiosity as that with which we ourselves now look at the pictures of the coaches that were conveyances of 100 years ago.

The Detroit, Toledo & Ironton Railroad, which is owned by Henry Ford, has announced that it is building a new type of electric locomotive for its own use. In size it will be enormous. It will weigh 340 tons, will be 117 feet long, 15 feet high, and 10 feet wide. What is more interesting still, it will have sixteen 250-horsepower motors connected with 16 pairs of driving wheels, and will be capable of hauling a train of 150 or more loaded box cars.

Its running speed will be 17 miles an

(*Continued on page 129*)



Cutting Costs with New Diesel Locomotive

In recent tests on an English railway, this small new type of Diesel locomotive is reported to have hauled a train at a cost of only three cents a mile. Instead of using coal or steam, the Diesel engine gets its power from explosive combustion of oil under high pressure

Can You Walk a Chalk Line?

You may think you can make your steps go straight, but really you wander in circles—Why whirling makes you dizzy—How to test the intricate balancing machinery of your body

Try This Test on Yourself

To find out just how straight you can walk, pick out a tree or some other object two or three hundred yards away, then have somebody blindfold you and start you straight for it. Unless you are a very unusual person, you will find that you walk in circles either to the right or left. In carefully measured tests the author invariably turned to the right, as in Figures *A*, *B* and *C*, while another subject of the experiment always turned to the left of the straightaway course, as in *D*, *E* and *F*

By Robert E. Martin

HAVE you ever tried to walk a chalk line? If you have, you probably found it difficult. The reason is obvious—your supporting base was narrowed, and you had to support your body almost on a point.

But can you walk in a straight line employing your usual gait, with feet at a normal distance apart? Without hesitation you will say "yes." However, unless yours is an unusual case, you are wrong. You can't do it. This has been proved definitely by interesting scientific tests recently completed.

The reason is that most people are more or less crooked in their habit of walking. They think straight, and they think they walk straight, but they do not. So far as actual walking is concerned, for the average pedestrian the straight and narrow path is merely a figure of speech. The chances are that not even a narrow city sidewalk will keep the average man moving head-on for the spot toward which he charts his course.

Try it yourself. Walk across a wide plaza or through an open meadow. Pick out two fixed objects directly in front of you and try to keep them in line as you walk. Unless you make a concentrated effort, not permitting your vigilance to relax even for a second, you probably will find that your guide-posts simply refuse to stay lined up.

If you play golf, you probably know this to be true from the frequent misadventure of the lost ball. After a whacking drive, you start straight ahead for the spot where the ball landed. As you walk you talk. Naturally, you don't concentrate on accuracy of direction. And then, all at once you awake to the realization that, although the ball may have fallen where you thought it did, you're nowhere near the spot.

In the woods you'll meet the same problem. You may pride yourself on your sense of direction, you may know that the fishing pool is straight ahead, and yet, when you leave camp to go there, you will do well to carry a compass! Otherwise, you're likely to find yourself walking in circles like the man Mark Twain told about. This man, one evening, was caught in a blizzard. He knew that shelter was close at hand, and yet he walked all night without finding it. Morning revealed the place of refuge he had been looking for right at his elbow. He had been walking around it all night, for there was his circular pathway marked by his tracks in the snow!

Nor are darkness, woods, or blizzards required to induce this circular habit of locomotion. Walking on level, familiar ground, with your eyes wide open and the sun shining, you'll find this tendency to travel in circles asserting itself.

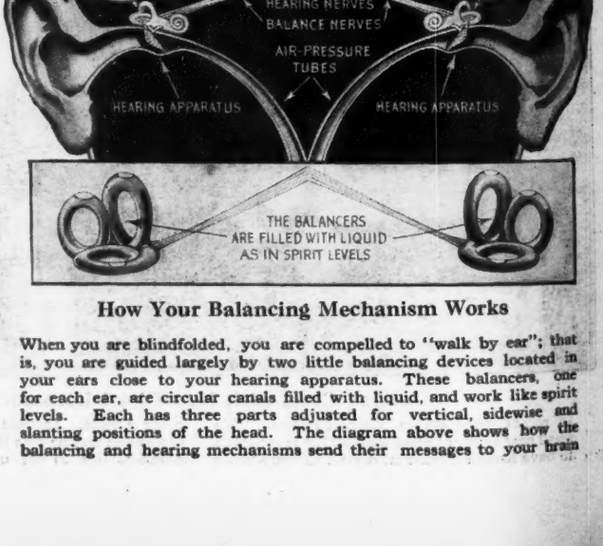
At the Johns Hopkins University, Baltimore, Md., Dr. J. Q. Holsopple, of the department of psychology is investigating equilibrium and orientation, which means your ability to keep your balance and your direction. Recently he told me many interesting things about this propensity of mankind to move like the hands of a clock—round and round. More, he demonstrated everything he said in a way that I was bound to find convincing, for he used me as a "subject" of his tests.

THE straightest of all walkers—virtually the *only* straight walker among mankind—this scientist told me, is a blind man. The blind have a definite advantage over men who see, for they have developed, from necessity, a special idea of direction. Experience has taught them that painful bumps and barked shins result from deviation from a straight path; and so, by virtue of long experience, they regulate their bodily movements to produce straight progress.

There is a sharp contrast, though, between the pathway of a blind pedestrian and one who is merely blindfolded, a fact demonstrated amply by the helplessness of the "blind man" in a game of blind man's buff, or the person who tries to pin the tail on the donkey.

Doctor Holsopple uses the blindfold frequently in his story of human balance and direction. When a man is blindfolded, he is forced to "walk by ear." It may surprise you, as it did me, to learn that we walk partly by ear whether our eyes are open or not. In the vestibules of our ears are semicircular canals—two sets, one for each ear—and these govern our ability to maintain our balance and to walk straight.

Each canal has three parts, which may be described as being adjusted respect-



How Your Balancing Mechanism Works

When you are blindfolded, you are compelled to "walk by ear"; that is, you are guided largely by two little balancing devices located in your ears close to your hearing apparatus. These balancers, one for each ear, are circular canals filled with liquid, and work like spirit levels. Each has three parts adjusted for vertical, sidewise and slanting positions of the head. The diagram above shows how the balancing and hearing mechanisms send their messages to your brain

ively for vertical, sidewise, and slanting positions of the head. When the canals are disturbed, dizziness may result, as in the case of a child whirling about and becoming "drunk" from the motion.

It is not, though, the whirling motion that causes the dizziness, Doctor Holsopple told me; it is the irregular succession of sudden starts and stops, that disturb the ear canals. In his laboratory is a chair, mounted like a dentist's or barber's chair, which can be rotated steadily by an electric motor.

I got into the chair, and the motor whirled it about with a speed that was almost terrifying. I expected that the room would be reeling when the chair was brought to a stop. But it wasn't. Walls and furniture remained exactly where they belonged.

I ASKED Doctor Holsopple just what this test had to do with walking straight.

"It is one of the means I use to demonstrate the importance of the semicircular canals of the ears in maintaining equilibrium and direction," he explained. "Ordinarily, we gage our position by sight. We also use the sense of touch. An aviator, for example, uses the pressure of his safety belt or the sides of the chair in which he is seated to guide him in piloting his craft.

When you ride in a train or an automobile, the pressure of the seat against your back tells you that you are moving. Likewise, the pressure of the elevator floor against the soles of your feet tells you when an elevator is rising.

"Touch, though, is an uncertain indicator. Close your eyes when an automobile or train is slowing down, and, when it finally stops, it will seem to you that you are *going backward*. Close your eyes in a rising elevator, and, when it slows down, it will seem to you that you are *falling*. This is because the fluid in the ear canals has been flowing in the direction of your motion, and, when you stop, it continues to press forward. The effect of this is to give you the same sensation you experience when you move backward."

DOCTOR HOLSOPPLE had me seat myself in his revolving chair again, and whirled me round and round to the right. True to the prediction he had made before the test began, when the motion stopped, for a half-minute or more I felt that I was turning to the left—the direction opposite to that in which I had been revolving. When he spun the chair with reverse motion—that is, to the left—the sensation of turning to the right persisted for a half-minute after stopping.

Then he asked me tc lean forward almost until my chin touched my knees while he rotated the chair to the right. When I tried to straighten up, I seemed to be falling to the left. Had I endeavored to overcome this sensation, Doctor Holsopple told me, I should have fallen in reality in the direction in which the chair had been whirling—namely, to the right.

Another test illustrated even more vividly the vital effect of the ear canals on the sense of direction. Doctor Holsopple asked me to touch a spot on a large card that he held before me as I sat in the chair. He told me he was going to whirl the chair about again, and that he wanted me to touch the spot on the card when the motion ceased. The chair revolved to the right. and when I attempted to touch the spot, I missed it by almost two feet to the left-hand side.

A Race without a Course

Here is shown Svend Mannerheim, Swedish athlete, winning an odd sort of cross-country race held recently near Stockholm. The contestants were required not only to run fast, but to find their way without compasses, markers, or other help from start to finish. How well do you think you could do in a race of that sort? Try the tests described in this article. You probably will be astonished to discover how crookedly you walk and how difficult it actually is for you to find your way about

Try these tests yourself. A piano stool or a swivel chair can be used instead of the special chair of the psychologist's laboratory.

"Such tests," Doctor Holsopple told me, "throw light on the effect that stimuli from the semicircular canals of the ears have in controlling our movements. From them science will learn how seriously a defect in the canals may influence our every-day behavior.

"A simpler test is that of blindfolding a person and directing him to walk to a tree a few hundred yards away. The ground is level. A surveying instrument is used to measure the accuracy of the walker's course. Some subjects, while they start out straight for the tree, quickly veer to the right or left. It is a strange thing that any one person, no matter how many times he tries the test, always will turn in the same direction.

"IN SWEDEN they have an odd but highly interesting athletic game. It is in effect a cross-country race, but to win it a contestant must not only be the first to cross the finish line, but also must demonstrate a highly developed sense of direction and an ability to orientate himself, for he must find his way through strange country with no guidance except his own instincts. The average man would make but a poor showing in a contest of that kind. Maybe you would like to see why this is so?"

Once more I became a subject for experiment. My pathway, on each of several attempts to reach the tree, is indicated by the figures *A*, *B*, and *C* in the diagram on page 26. After several failures, I tried to beat the game by leaning to the left. I had an idea that this would counterbalance my tendency to turn to the right, but it made no difference. Another person who tried the same test always moved to the left.

ANOTHER phase of this problem of balance and orientation, Doctor Holsopple told me, is presented by antagonistic muscles. This means that certain groups move in a way that exactly opposes the movements certain other groups are making at the same time, as when the biceps contract and the muscles of the back of the arm relax when the hand is brought to the shoulder. The eye muscles are another example. When the eyes turn in the head one set of muscles relax and the opposite set becomes tense.

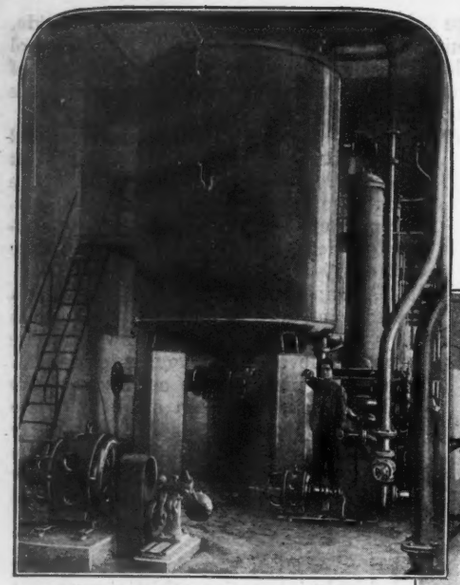
"Why does a person walk crooked?"

"That's what we want to know," this psychologist told me. "The causes are complicated. Doubtless some of them are muscular. In the legs and trunk, for example, one muscle may be pulling harder than its antagonist.

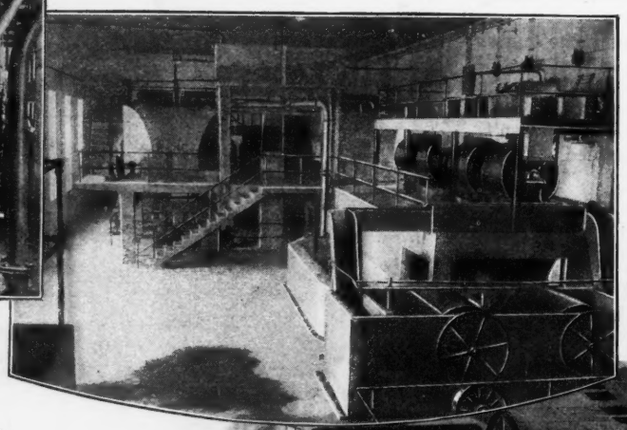
"Perhaps a contributory cause may lie in chance, such as the swaying of the body. A deviation of this nature may not be corrected by the semicircular canals, and consequently it influences the walker's direction. The chance occurrence may take the form of a sharp gust of wind, or of some trivial influence that swings the person off balance."

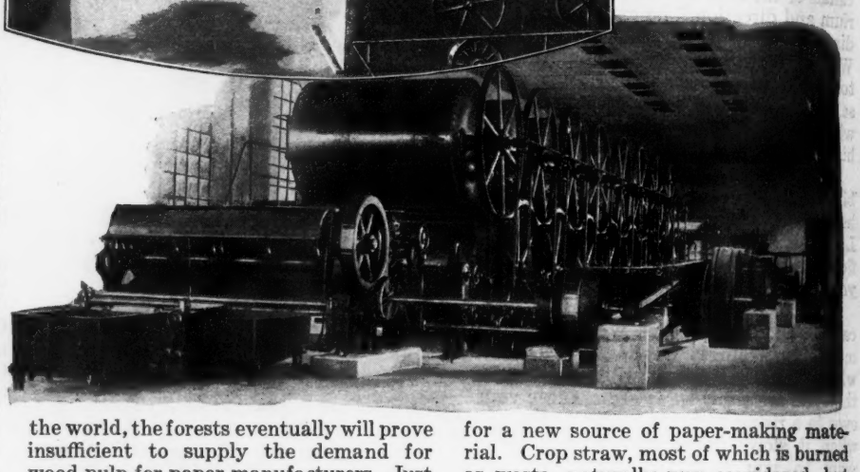
High-Grade Paper Made from Waste Straw

Threatened Famine May Be Prevented by a New Process of Salvaging Crop Rubbish



The Digesting Plant. Here the straw fibers are converted into pulp—the first stage in the new method of manufacturing of paper





The Paper Factory

Two interior views of one of the European factories where paper of high quality is being manufactured from straw by the new De Vains process. At the left is the bleaching plant where the straw pulp is made snowy white. The only chemicals used are common salt and lime. Below is a battery of huge rollers that transforms the pulp into paper sheets

By Newton Burke

FROM Europe recently came the announcement that science had produced an effective process by which the waste straw of food crops, such as wheat, barley, oats, corn, and rice, may be utilized as a substitute for the wood pulp from which 90 per cent of the world's paper now is made.

The process has been developed by M. De Vains, a French inventor, and depends upon a method of eliminating the hard brittleness which previously had made impossible the use of straw fibers in the manufacture of printing and writing paper. The De Vains process has been installed successfully in a dozen paper and pulp mills in European countries, and plans are now under way, it is said, to establish a large experimental plant in Canada, where the great wheat crop will provide an abundance of raw material.

Canadian wheat straw, it is announced, already has been employed effectively in the manufacture of paper by means of the new process in Europe. The paper produced in the mills where the process has been installed is said to be excellent in quality, a special bleaching method producing a pure white paper when desired.

Paper from straw, of course, is nothing new. Straw paper was made in this country a half-century ago; also in Europe. Straw is used also in the manufacture of strawboard and several types of cheap wrapping paper. But paper made from straw fibers, matching in quality the paper manufactured from wood pulp, is a distinct novelty, and a successful process that makes it possible is bound to prove of tremendous significance, not only to the paper industry, but from an economic standpoint.

Foresters and economists long have maintained that, despite efforts to replant woodlands of the world, the forests eventually will prove insufficient to supply the demand for wood pulp for paper manufacturers. Just how terrific is this demand is shown by the fact that the United States alone requires 7,500,000 tons of paper every year. Fifty years ago this country's annual consumption of paper was only 500,000 tons; in another 50 years, it is predicted, it will be 20,000,000.

Because of this apparently inevitable famine, paper manufacturers have sought for a new source of paper-making material. Crop straw, most of which is burned as waste, naturally was considered, but the hardness and brittleness of the resulting pulp made it unsatisfactory.

THE luxuriant vegetable growth of the tropics likewise was considered; but, though tropical grasses, bamboo, and similar vegetable products were found suitable for paper manufacture, the difficulty of transporting chemicals and fuel to the tropics made this virtually inexhaustible source of pulp of doubtful value to the paper-using world.

Ten years ago De Vains attacked the problem of developing a process whereby straw might be used in paper manufacture.

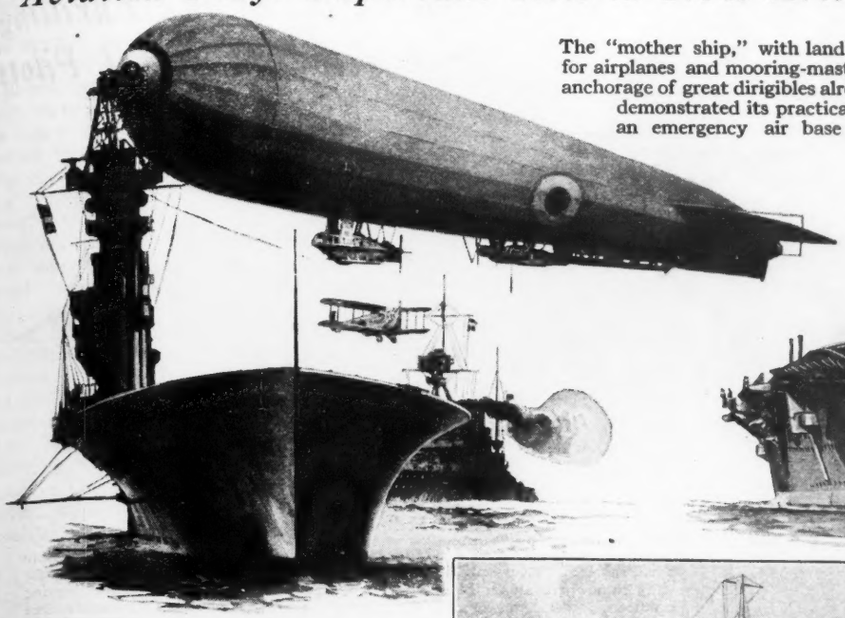
Advices from Europe indicate that he has solved the problem. The only chemicals employed in his process are common salt and lime. Soda and chlorine, which are necessary for the separation of the paper-making fiber, are produced from the salt through his process by electrolysis. Ingenious machinery and an ingenious adaptation of well-known chemical reactions cause the soda and chlorine, after their work is done, to recombine as salt, which may be used again.

Where Straw Is Burned as Waste

A typical Canadian harvest scene. It is estimated that the straw burned as waste after the harvest every year is sufficient to produce 50,000,000 tons of paper, or more than the present requirements of the world, also that straw from a field 10 miles square would keep a paper-manufacturing mill busy for a year

Do We Need More Ships like These?

Aviation Plays Important Rôle in New British Naval Designs

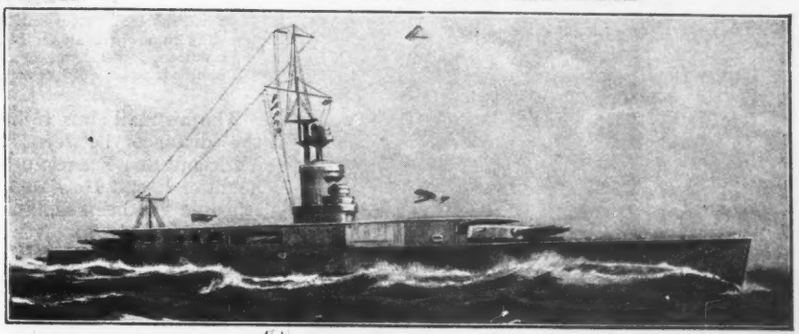


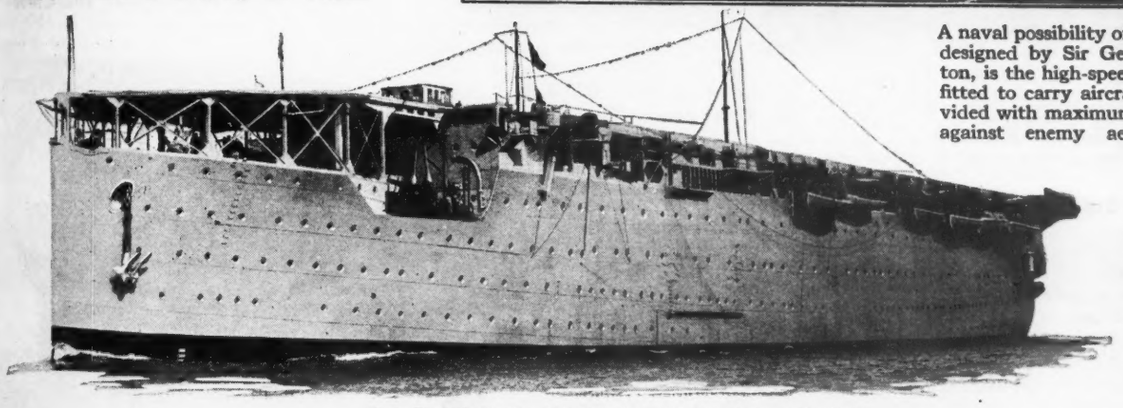
The "mother ship," with landing deck for airplanes and mooring-mast for the anchorage of great dirigibles already has demonstrated its practicability as an emergency air base at sea

With funnel, mast, and bridge to starboard, providing a wide landing-field on the upper deck, the British aircraft-carrier *Hermes* can accommodate 20 planes

THE great sham battle staged by the American Navy this spring off the coast of Lower California to test the efficiency of the modern warship in defense against attacking aircraft has brought to a head the lively controversy over the question: Is the airplane making the battleship obsolete as a weapon of naval warfare?

Great Britain's most recent answers to that question are found in these new designs of aircraft-carrying war vessels

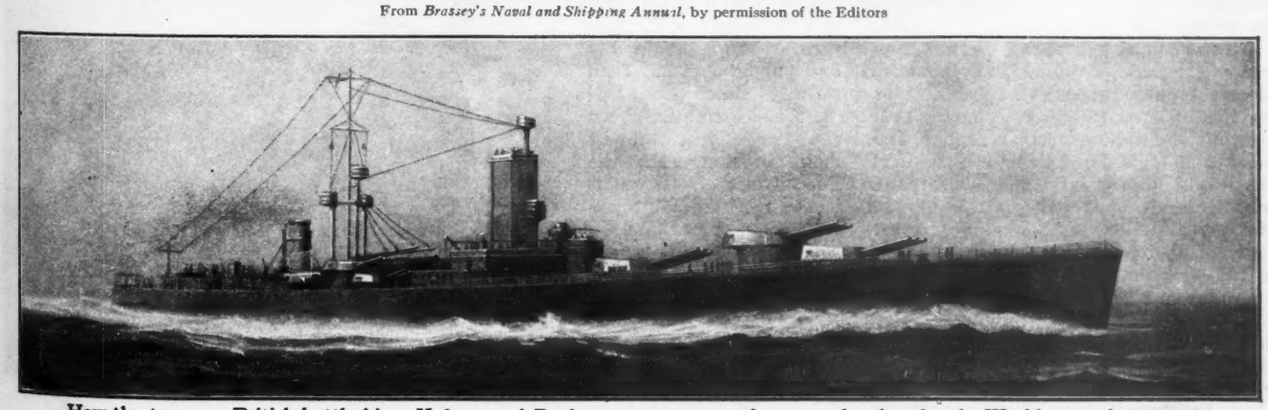




A naval possibility of the future, designed by Sir George Thurston, is the high-speed battleship fitted to carry aircraft and provided with maximum protection against enemy aerial bombs

The landing-deck of the British aircraft-carrier *Argus* is clear of all obstructions, the smoke being emitted aft

From *Brassey's Naval and Shipping Annual*, by permission of the Editors



How the two new British battleships, *Nelson* and *Rodney*, may appear when completed under the Washington Armament Treaty. It is reported that their armament will include nine 16-inch guns, making them the most powerful battleships

Those Who Carry Our Mail

A Narrative of the Thrilling Adventures of Postal Pilots

A 3000-Mile Path of Adventure

The route of Uncle Sam's Air Mail, bridging the United States from New York to San Francisco. Every night and every day of the year a score of fliers are on the wing somewhere along this pathway, plunging through storm and fog, braving unknown perils. And although there are 14 stops, the mail-planes have been on time in nine trips out of 10, covering 50,000,000 miles in 33 months with 157,000,000 letters

The World's Highest Beacon

This 5,000,000-candlepower lighthouse of the U. S. Air Mail, which is the highest in the world, surmounts Sherman Hill, itself 8600 feet above sea level, on the top of the Rocky Mountains between Cheyenne and Laramie, Wyo.

By Norman C. McLoud

AIR-MAIL pilots do more than carry the mails. Each day of their lives opens for them a new chapter of thrill and adventure. Constantly, day and night, 20 of the 70 fliers who compose this branch of the postal service are on the wing somewhere between New York and San Francisco, and just as constantly danger and excitement lurk in their path.

Whence peril will spring they cannot guess. It may come while they sweep along in apparent security over the wide, level plains of the West, or it may appear as they fight their way through impenetrable fog amid the rugged heights of the Rocky Mountains. The blizzards of winter, the fierce lightning of the summer storms, the failure of their planes, either in mechanism or structure—any of these, or a thousand other causes, may bring the pilot face to face with death.

Indeed, it is a lucky one among these aerial mail carriers who has not suffered the fiercest hardships and gravest dangers many times in the few brief months since the establishment of mail delivery between oceans in less than a day and a half.

The air mail aims to bridge the distance between New York and San Francisco in 34 hours or less. How well this schedule has been maintained by these hardy and venturesome aerial postmen is shown by recently compiled records of the Post Office Department.

In two years and nine months the air mail has covered 50,000,000 miles with 157,000,000 letters weighing 4,000,000 pounds. There are 14 stops on the transcontinental route, yet in nine trips out of 10 planes have been exactly on time both at intermediate stations and at terminals. The poorest time westbound was 55 hours and 40 minutes, or more than 30 hours better than train schedules. Eastbound the slowest trip was 57 hours and 39 minutes, or more than a day and night better than railway mails.

So successful has been the transcontinental air mail, in fact, that the Post Office Department has been stimulated to extend the service. Within a few weeks, it is announced, there will be started a double-track service between New York and Chicago, with a flying time of between eight and nine hours, and overnight delivery of mail between the cities.

The tentative schedule provides for plans to leave New York and Chicago each night at 9.30 and to arrive at the other terminus at 5.30 the following morning. It is not contemplated to handle other than New York and Chicago mail, except of course such mail matter as ordinarily is relayed between the two cities. Three stops have been provided—at Bellefonte, Pa., and Cleve-

Dauntless Courier of the Sky

Here, in his flying togs, is Pilot Paul P. Scott, whose recent adventures in carrying the mail form one of the most thrilling of modern romances. He has battled his way through a series of hardships that began a few weeks ago, when his plane crashed against the side of a mountain

in the Air

land and Bryan, Ohio. The stop at Cleveland will be made to change planes, the other two for refueling. Eventually the original plan may be modified to drop off mail at Cleveland.

Recent experiences of Pilot Paul P. Scott serve as conspicuous examples of the ends to which the heroes of the aerial mail service go in order to maintain their schedules. When this navigator bumped into a mountain a few weeks ago, he began a series of adventures that the official records of the Post Office Department describe as "hardships not surpassed by any experiences of the world fliers who circled the globe in army airplanes."

Scott left Salt Lake City flying-field with mails for Reno and the West. Dense fog hid everything from sight. The first thing the pilot knew he had crashed into a mountain with terrific force. The next thing he knew he was waking up in the snow, with his machine on top of him. His own report on the incident supplies a graphic and thrilling chronicle:

"I LEFT Salt Lake at 12.42 P. M.," he writes, "and encountered snow and mist from the first. The visibility was very poor as far as Silver Zinc Pass. At Shafter the weather cleared with the exception of ground fogbanks to northwest and south.

"I headed south to go around the mountain range, when I noticed a small hole between the fogbank and the clouds, through the saddle-pass on the regular course. The lowest part of the saddle is about 300 feet wide, and can be cleared at an altitude of 7200 feet. On each side of the saddle the altitude of the range is about 8500 feet.

"No part of the mountain range was visible. I had proceeded through the hole, with altimeter registering 7800 feet, to what I thought was halfway through, when the hole closed up in front. Then I banked the plane, and was turning to come out when the fog closed in behind me, the visibility now being not more than 20 feet.

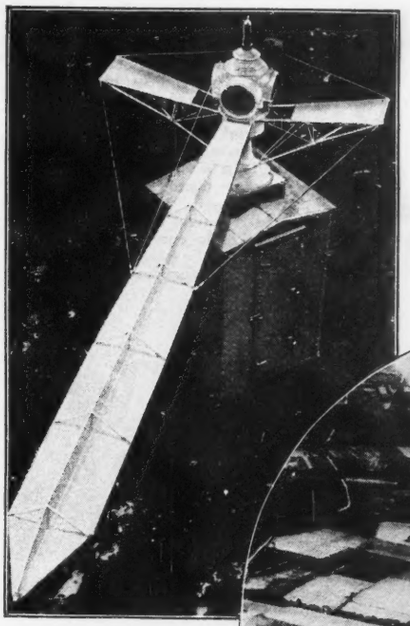
"No sooner had I leveled the plane off and started climbing than I saw I was scraping the tops of cedar trees.

"I pulled back the throttle and the stick, together, and crashed on the slope of the saddle at about 8200 feet.

"When I came to, my face was buried in the snow and I was groping for the switches with my right hand. My left arm and hand felt numb and useless. I could not locate the switches, so I unfastened my belt and dug snow enough to pull myself from under, with the aid of a convenient cedar limb. The machine was completely 'washed out.'"

At this point Scott showed himself an observer as well as a pilot.

"Then I began noticing things," he continues. "I noticed that my left shoulder was out of place, and that my arm was freezing rapidly; that I had cigarettes and matches; that I had left my gun in Salt Lake; that there was a heavy fog, with no sun visible to get

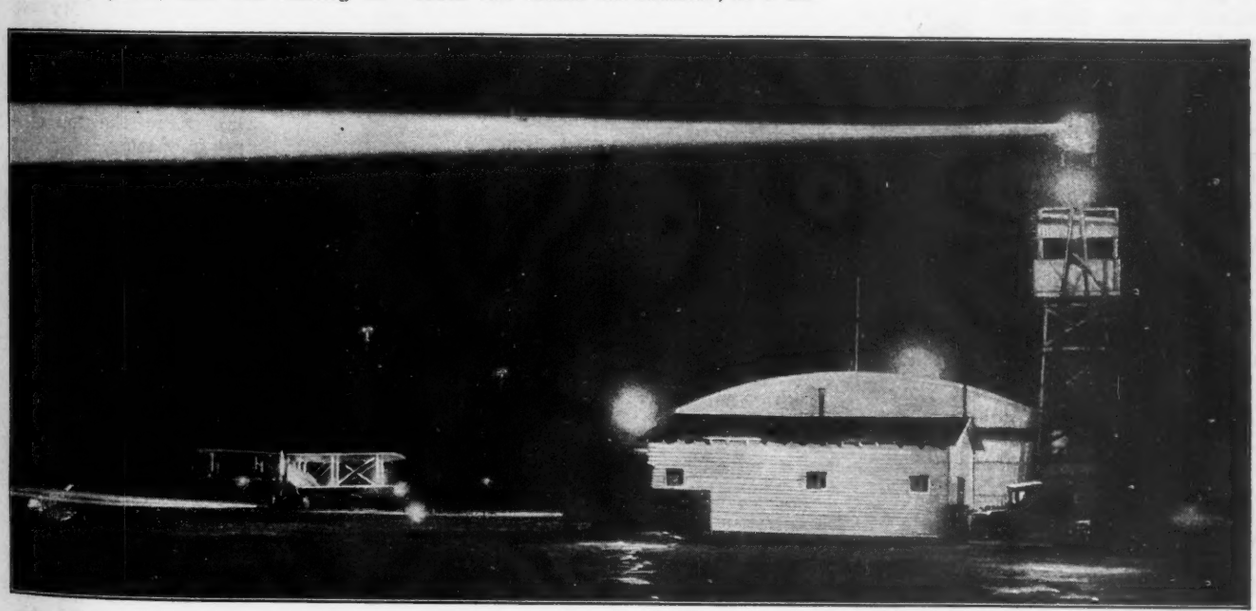


Wind Indicator

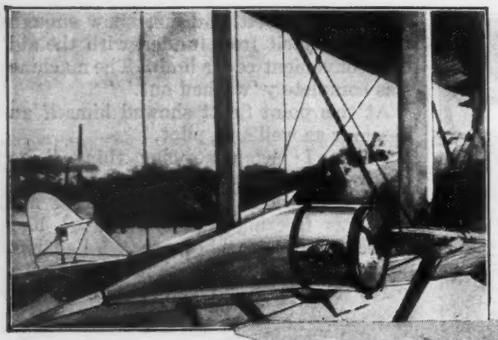
Emergency landing-fields are equipped with this combined beacon and weather vane. It casts a guiding beam that can be seen for miles. The illuminated T below the beacon swings around, telling the air-mail pilot, many feet above, the direction of the wind at his landing place

A Floating Flare

The night-flying plane carries a brace of flares for use in case of forced landing. When one of the flares is lighted and dropped, it illuminates the countryside for half a mile in every direction, enabling the pilot to select a safe landing-place. Notice how the flare floats, suspended from a parachute. It lasts for about 10 minutes

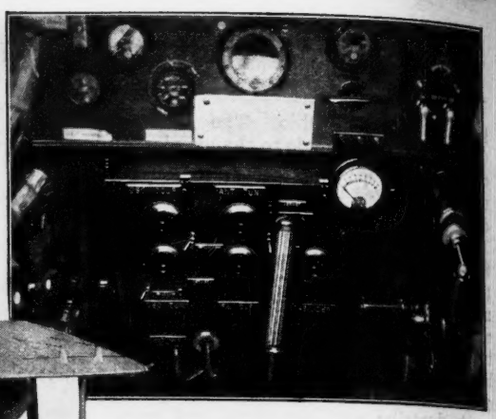


Remarkable nighttime view of the U. S. Air-Mail Field at Iowa City, Ia., showing a mail-plane making a landing under the beam of a powerful beacon. Brilliant illumination of the field virtually turns night into day, assuring the safety of the pilot and his precious cargo



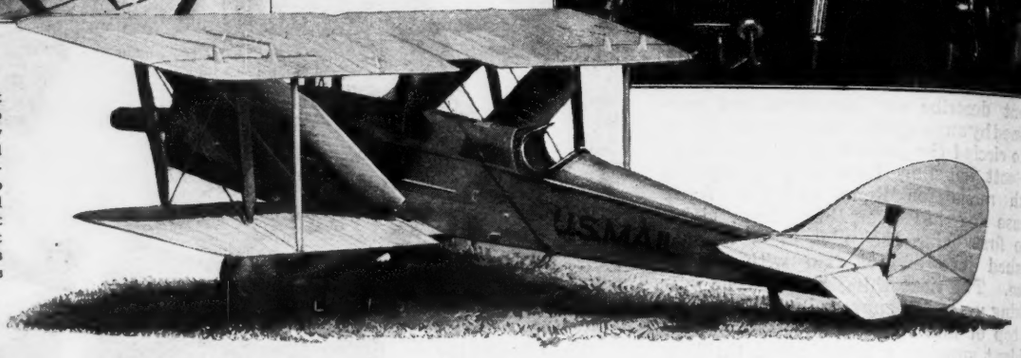
Mechanical Aids for the Air Pilot

Powerful "headlights" on the lower wing help to guide the air-mail pilot in making night landings. Note how the lamp at left is streamlined. At the right is a view of the instrument board in the pilot's cockpit. In addition to the usual controls there is radio equipment with which the pilot receives the weather reports



New Mail-Plane

In 100,000 miles of test flying between Chicago and Cheyenne, this new type of mail-plane is said to have demonstrated superior speed, ability to make slower landings, and lower operating costs. It is reported to be almost foolproof against disastrous tail spins or nose dives



bearings; and that I was extremely lucky to be able to notice anything at all."

Scott's luck continued to hold. After his miraculous escape, he started down the mountain. The snow was deep and walking was difficult.

"In a short time," he says. "I slipped on some shale rock, striking my left shoulder, and knocking it back into place. Then I rubbed my left arm and hand with snow until they thawed."

The flyer walked to the nearest railway tracks, flagged a train, wired headquarters, and returned to Salt Lake.

THE marvel of Scott's escape from death was emphasized by the discoveries made by the relief expedition that went in search of him before his telegram reached civilization. Field-Manager Bernard Main and Mechanic James L. Farrow conducted the search in an airplane. With them was Mechanic F. E. Barnard, at the control stick.

The relief party itself became stranded in the mountains, through engine failure, two miles from a railroad, 10 miles from a telephone, and in a howling blizzard with a 50-mile wind. The searchers had only three sandwiches and three tins of sardines, and hunger and exhaustion crept upon them before they found the wreck, described by them as the worst they ever saw.

Despite such thrilling episodes as that in which Scott figured, there is no hysteria in the service, according to Col. Paul Henderson, second assistant postmaster-general, who has charge of the air mails.

"Our schedules are approximately four hours longer than our experimental flights indicated to be practical," Colonel Henderson said. "Pilots no longer fear flying at night. It is taken for granted that night flying is here and here to stay. New-Yorkers no longer are astounded when they get letters that left San Francisco early the day before. I am confident that this transcontinental service is a fixture. San Francisco is permanently moved up to within 34 hours of New York, from the viewpoint of the Post Office Department."

Pilot Wesley L. Smith confirms the statement that the men of the mail-planes no longer fear flying at night. Smith is the man who took off the first plane when the new service was established on July 1, 1924. He is a vocal student and flying is his means of paying for his education. During the war he was a lieutenant in the Army Air Service.

"Night flying is not a bit more hazardous than flight in broad daylight," according to Smith, "if the night is clear and the moon is doing its full duty. Of course, it cannot be denied that hazy nights are undesirable, but the thing I fear most is day flying in a severe storm.

"Even the storms are not as bad as they might be. In summer the average storm is less than 10 miles in width, and a pilot may fly above it, or he may pass through it in five minutes. Bucking a storm, however, is filled with more thrills than normal night flying over the lighted airway extending from Cleveland to Cheyenne. My own worst experience was in daylight, when I was forced down in the Alleghany Mountains and landed in the top of a group of trees.

"All a pilot has to do, day or night, is to keep his head. In case of mishap he always can save himself by jumping, with his parachute, or perhaps he can reach safety by shutting off his motor and gliding. For the skilled pilot gliding is not difficult.

"One of the worst enemies of the airplane is the dense fog, in which the pilot cannot tell when he is approaching a mountain or other obstacle. Happily an instrument is being perfected that will enable him to feel his way through a fog, and when

(Continued on page 125)

Giant London-Paris Plane

© Aerofilms, Ltd.

One of the giant new planes used in carrying passengers and mail between London and Paris. It is driven by the largest single engine in the world, a 16-cylinder Napier that delivers 1000 horsepower. Compare size of the plane with the men

If You Were Trapped in a Burning Building—

You, Like Hundreds of Others, Might Owe Your Safety to the Science and Daring of the Rescue Squad

By Ama Barker

ABOUT four o'clock one morning 10 years ago a policeman, patrolling a congested factory district in lower New York, saw smoke pouring from the cellar of a four-story loft building.

The chief of the fire department responded to the subsequent alarm, together with four engine companies. When the basement doors were burst open, thick, black smoke choked the entrance. The chief went to a call-box and in Morse code sent: 2—pause—3—pause—2—pause—then the box number 1, the fire-department rescue company's special call.

A few minutes later six men in oxygen helmets plunged into the cellar. They groped their way through the stifling smoke and located the seat of the fire. Returning, they got two lines of hose into action. Fifteen minutes later the fire was out.

Had the firemen not been protected with oxygen helmets, had they not been able to get at the fire while it was still small, there is no telling what the loss of life and property in that crowded district might have been.

The laconic account of the work done by the rescue squad at that particular fire is a significant item on the official report of the New York Fire Department, because it marked the beginning in that city of specialized rescue work that has saved hundreds of lives and millions of dollars.

It was New York's first application of scientific apparatus for this particular kind of work.

But, allowing for difference as to time and place, this memorandum of service might have been taken from fire-department records of any one of a number of cities where, in the last few years, picked squads of firemen have been assigned to man special scientific equipment, assisting the regular engine and hook-and-ladder companies.

Perhaps the first rescue squad attached to a fire department in this country was organized in Detroit in 1908. This company's special equipment was limited to a single life net, but it blazed the way for the highly specialized work now being carried on in most large cities and many small ones. Gas masks were used by San Francisco firemen as early as 1909 and Chicago had three auxiliary squads for rescue work in 1909. However, it remained for the New York Fire Department to equip the first rescue company with dependable oxygen masks and to equip a company truck with a variety of special scientific and mechanical apparatus that was useful not only in fire-rescue work but in almost any emergency where lives might be in peril.

AND to-day fire-department officials all over the country are constantly on the lookout for new inventions and improved apparatus that may be utilized by the men whose lives are devoted to the saving of human beings from death in fire and smoke. Almost every day science offers some new aid in this thrilling and useful work.

Oxygen helmets, pulmotors, special fire-quenching chemicals for use where

Photos © Keystone

Talking to His Men

The commanding officer of the rescue company, equipped with portable telephone apparatus, receives messages from his men reporting conditions in a gas-filled cellar. The men all wear telephone helmets

Answering a Call of Peril

New York City's Rescue Company No. 1 speeding to a blaze in one of the most dangerous fire districts. Every man in the company wears a medal for distinguished bravery. The upper picture shows a member of the rescue squad bringing out a comrade overcome by gas fumes

The pulmotor, an important part of the rescue-squad's equipment, has saved many a fireman overcome by smoke or fumes. In Chicago last year 260 persons were saved by this means

water would be ineffective or dangerous, acetylene torches for cutting away metal barriers, unusual types of crowbars and other wrecking tools for quick destruction of impeding doors and partitions—such apparatus is now as common almost in the equipment of the rescue firemen as are hose and water in that of the ordinary fire-fighter.

To such apparatus and to the skill and bravery of those who man it, thousands owe their lives. How much the appalling toll in lives that fire exacts in this country every year might have been reduced by a wider use of rescue equipment it is impossible to estimate.

Fire rescue is highly specialized work, and can be performed properly only by picked men after thorough training. One reason for this is that special skill is required for the operation of the complicated rescue apparatus, another that the apparatus requires special care if it is to be kept in condition for immediate use.

AND so firemen, as a preliminary to joining rescue companies, go through weeks of stiff training with gas masks, acetylene torches and many kinds of forcible entrance tools. Besides learning how to use all this equipment, they are taught also how to take care of it, to detect signs of trouble with the apparatus, and to make repairs.

The oxygen helmet used by rescue firemen bears slight resemblance to the gas mask of the trenches. The latter owed their efficiency to chemical filters that absorbed the poison gases, which, of course, were usually well diluted with air when they reached the soldiers. Masks of this type had been tried out by various fire departments before the establishment of the first rescue squad, but were found virtually no protection against thick smoke, ammonia, or other chemical fumes frequently encountered in fires in industrial establishments.

The helmet in use today is of a type similar to that used in mine-rescue work. It is equipped with an oxygen tank designed to give the wearer a supply of pure oxygen for an hour. An indicator registers the amount of oxygen consumed, and even when this registers zero, there is still enough oxygen in the tank for 20 minutes' additional use.

BEFORE the adoption of the oxygen helmet, Chicago firemen were called to a blaze in a meat-packing house. An ammonia tank on the third floor, part of the refrigeration system, sprang a leak, an explosion followed, and several employees were overcome. Firemen from the first truck company that reached the fire entered the building wearing the old-style filtration masks and endeavored to reach the third floor. The ammonia fumes, however, drove them back, and before they could reach the street, three of them were overcome.

It was with the greatest difficulty that the employees—among them 12 women—were taken on ladders from the third floor, and one woman was dangerously injured when she jumped from a window. All of these persons could be led to safety readily by Chicago rescue firemen of the present day.

A vivid instance of the value of rescue equipment in combatting difficult fires was given to the writer by Lieut. Thomas F. Kilbride, senior officer of New York City's Rescue Squad, and the only surviving member of the first rescue squad formed in that city. This is a story of a fire in a submarine lying at a pier in the Brooklyn Navy Yard, caused by an explosion in the aft battery compartment that injured several men.

"When we got there a few of the injured had been rescued by Brooklyn firemen," said Lieutenant Kilbride. "But the burning insulation on electric wiring and repeated explosions made the fumes and smoke so dense and the heat so terrible that men without masks couldn't get any farther than the battery platform without being overcome.

"THE naval officers said the explosions were caused by chlorine gas coming in contact with electric wires charged with 600 volts. This gas had been formed by the mixture of sulphuric acid and salt water used in the wet batteries.

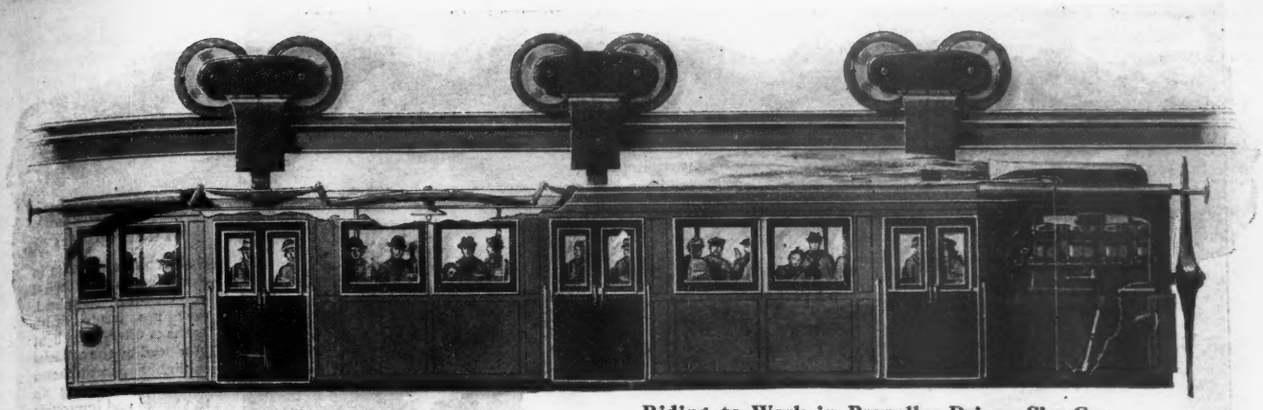
"Red-hot electric wires, caused by short-circuiting and burning insulation led through the magazines, loaded with smokeless powder, TNT, and a lot of gun-cotton. In addition, the boat was carrying eight torpedoes of the largest type with their war heads on, ready for action. The steel jackets were so hot you couldn't touch them with your bare hands!

"The only way we could get down to the fire was through an opening in the hull, about 22 inches in diameter. And once inside we had to crawl about and fight the fire with small hand extinguishers. Salt water could not be used to flood the compartments, because its action on the electric batteries would have caused more explosions. Fresh water was used to dilute the batteries, but the fire had to be fought mainly with hand

(*Continued on page 128*)

A Thrilling Moment—Shooting a life-line up, as a last resort, to a couple trapped on the roof of a burning building. They are seen above with the rope that brings them safety. Many rescues have been made in this way

Freeing a Victim—The acetylene torch is an invaluable weapon of the rescue squad. In two or three minutes it can cut through heavy iron bars that imprison fire victims, saving precious time in rescue work



Riding to Work in Propeller-Driven Sky-Car

The design of the proposed Paris-St. Denis commuters' airway car, showing monorail suspension and airplane propeller that would drive it at 60 miles an hour. Both ends would be tapered like an airship

A Mile a Minute by Aero-Railway

How Paris Plans to Solve Suburban Transit Problems

By Arthur A. Stuart

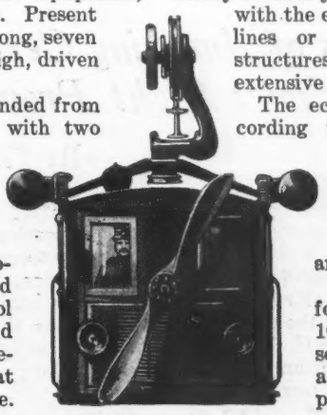
PARIS bids fair to be the first of the world's largest cities to solve its rapid-transit problems high in the air. Recent reports from the French capital indicate that actual construction work soon may begin on a remarkable high speed aero-railway, along which propeller-driven cars suspended from an overhead monorail will travel 60 miles an hour, carrying thousands of commuters between Paris and the suburb of St. Denis.

Designs for the airway have been completed, examined by expert engineers, and found to be practicable, it is reported. The inventor, Monsieur Francis Laur, a well-known French engineer and former Deputy of the District of Paris, has laid his entire scheme before the Prefect of Police, and now is waiting only for a concession on the line to begin work.

During the last year inventors in America and Europe have been at work on the idea of aerial railways to supplant the crowded commuters' trains, jammed subways, slow moving surface cars, blockaded taxicabs, and buses that have brought the problems of traffic congestion to a critical stage in almost every large city. One of the ingenious systems devised—the Felts suspended monorail car proposed for Los Angeles, Calif.—was described in POPULAR SCIENCE MONTHLY in November, 1923.

The proposed car of Monsieur Laur would differ from the Felts invention in the fact that it would be virtually a propeller-driven airship suspended from and running along a rail. Its body, tapering off at both ends like a dirigible, would be built of duralumin, extremely light. While it would be capable of carrying from 60 to 100 passengers, the entire car, including motor equipment, would weigh only five tons. Present plans call for a car 40 feet long, seven feet wide, and seven feet high, driven by a nine-foot propeller.

The car would be suspended from overhead carriages, each with two wheels in tandem, running on the monorail. It would be equipped at one end with a regular heavy-duty airplane propeller driven by a gasoline or electric motor, and at the other end a control cab. The propeller would be of the new metallic reversible type, turning at 2000 revolutions a minute. Thus, the car could be run in either direction and would not have to be turned around on the tracks. During rush hours an extra car or two could be hooked up to the propeller car, forming a train.



Front View

Notice how the car is suspended from wheels running on single rail

The track would be in the form of an inverse double parabolic arch suspension bridge holding up the rails, each suspension being about 480 feet long. Suspension cables would be strung on high steel towers guyed longitudinally and at right angles to the track to keep all motion from wind pressure at a minimum.

One of the chief advantages claimed for the proposed sky railway, aside from that of providing relief from traffic congestion, would be its economy of construction and operation. The initial financial outlay obviously would be small compared with the expense of digging subway lines or erecting steel elevated structures, or even of establishing extensive new lines of motor-buses.

The economy of transport, according to the inventor, would reduce the cost of tickets from St. Denis to Paris to about one-third of what even the street-railway companies now are charging.

The fares to be charged for the single trip of about 10 miles from the northern section of Paris to St. Denis, according to the present plans, would be about three cents. Express cars, not stopping at intermediate points, would make the complete round trip in a little more than half an hour. It is estimated that the line could handle more than 2,000,000 passengers a year.

If the proposed aerial line proves commercially successful, it will be followed by other similar lines connecting the heart of the city with its suburbs.

Monsieur Laur, who is 84 years old, has spent the past 11 years working on his aero-car.

An artist's first idea of the airline railroad, drawn several years ago. The track would be built like a suspension bridge

Light Baths Fight Tuberculosis

Tuberculosis patients in the Robroyston Hospital at Glasgow, Scotland, now are treated with baths of ultra-violet light produced by the artificial sunlight apparatus shown here. By building up the bones and improving the quality of the blood, ultra-violet light is proving an effective weapon against one of the most dreaded of all diseases

Magic Cures Found in Sunshine

Discoveries of Amazing Germ-Killing and Food-Giving Power of Ultra-Violet Light Promise Better Health for Everybody

By G. B. Seybold

AN EXPLORER returning recently from the Amazon remarked that he could not figure out why more savages did not die. Careless of infection, they treated their most appalling wounds, he said, simply by lying in the sun.

Experiments made at the U. S. Bureau of Standards recently gave an explanation. Bacteria found in sewage were exposed to ultra-violet light, a part of sunlight. Literally in a flash, in an exposure of less than a second, the bacteria were killed. Sunshine—the mysterious cure used by the savages of the Amazon to sterilize their wounds—was found by these experiments to be the most powerful non-chemical germicide known!

Accurate measurement of the tremendous germ-killing power of ultra-violet light adds one more proof of its value. More than 120 years ago ultra-violet light was discovered, but only within the last 10 years have its varied powers begun to be appreciated. Today it is being used, not only to fight disease, but to hasten growth of crops, produce more eggs, test paints and fabrics, season lumber, and sterilize water. Its utilization is one of the amazing accomplishments of our age.

Ultra-violet light, is not to be confused with the so-called "violet rays" that we see the salesman at the corner drug-store "demonstrating" with glass tubes of various shapes. These "violet rays" are merely the violet light that a high-frequency electric current produces when it is passed through a vacuum.

Ultra-violet light is a colorless, invisible part of sunlight. We know that sunlight passing through a prism breaks up into its spectrum—rays of red, orange, yellow, green, blue, indigo, and violet, each color having its own wave length. But besides these, at each end of the spectrum, sunlight contains waves respectively too long and too short to be seen by the human eye.

Beyond violet, made up of the shortest waves we can see, are much shorter waves. Although these have no effect on the retina, they will darken a photographic plate. These waves are ultra-violet light. By means of special instruments that convert the effect of the waves on photographic plates into electricity, or record their heat, these minute wave lengths have been measured. They are so short that their length cannot be computed in ordinary terms, so the Angstrom unit is used. An Angstrom unit measures approximately 1/250,000,000 of an inch. That is to say, it would take 10,000,000 of them to equal the diameter of a human hair of average thickness.

The waves of ultra-violet light vary in length from those just too short to be seen, 3900 Angstrom units long, to the shortest —1000 Angstrom units long. Beyond the ultra-violet region are the extremely short wave lengths known as X-rays.

IN THE Bureau of Standards test it was found that the shorter ultra-violet waves had the more pronounced action in killing bacteria, but longer ones were effective with longer exposure and when applied with greater intensity. Science, however, has learned to produce artificially ultra-violet wave lengths shorter than any of those in sunshine that reach the earth.

Ultra-violet light is emitted whenever an electric current is broken and the spark made to leap across a gap in an arc. Arc lamps used in motion-picture studios, for example, give off a large amount of ultra-violet light. The lamp most commonly used by physicians in ultra-violet treatments has poles of mercury in a quartz tube.

QUARTZ is used because ultra-violet light will not pass through glass. In winter our closed windows shut out the germ-killing part of sunlight. POPULAR SCIENCE MONTHLY told recently that a way has been found to make clear fused quartz in commercial quantities at a reasonable cost. Does this point to a time when we need no longer deprive ourselves of the help nature offers us daily? With quartz windows in our houses it would be possible to live indoors as healthfully as out-of-doors in the sunshine.

It is the longer ultra-violet waves that cause sunburn. In the concentrated ultra-violet light produced artificially the skin of any one under treatment is burned very rapidly. In two hours under ultra-violet light in a laboratory a person may acquire a coat of tan equal to the total result of a full summer's exposure at the seashore. In ultra-violet light baths the

eyes must be protected by goggles of any colored glass but quartz.

The first spectacular use of the sun as a doctor was in Switzerland, where physicians cured children of tuberculosis by letting them play naked, out-of-doors in the snow. Snow reflects ultra-violet light almost completely, thus giving the patients a double dose of the light—direct and reflected.

Perhaps the most amazing of all things accomplished by the use of ultra-violet light is the curing of rickets. In this disease the bones fail to develop properly on account of a deficiency of calcium and phosphorus in the body. Other diseases due to this same deficiency are hay fever, asthma and scurvy. Ultra-violet light is being used in the treatment of all of these.

After the cause of rickets was discovered, patients were fed calcium and phosphorus, but without favorable results; for the body could utilize only five per cent of the chemicals. Baths in ultra-violet light, however, in some way not yet fully understood, were found to cause the body to absorb 60 per cent of the salts introduced from without.

ULTRA-VIOLET light in the treatment of rickets does not get to the bones, but works in its tonic effects through the blood. It helps in the battle against tuberculosis by improving the quality of the blood. Red corpuscles, the food carriers of the blood system, and white corpuscles that fight germs, are made in the marrow of bones. Ultra-violet light, therefore, by enabling bone to take up necessary building materials, indirectly provides for more troops of working and fighting corpuscles.

Dr. Percy Hall, an English specialist in ultra-violet light treatment, has been experimenting with the use of the light in preventing influenza and dyspepsia, which he says is a form of influenza. Attacks of these diseases usually come in the winter when our bodies have little defensive power. By increasing the number of red blood corpuscles in the blood and the percentage of hemoglobin in these corpuscles by ultra-violet light, we can build up our resistance to disease, declares Doctor Hall. He predicts a time when we shall take light baths every fall to prepare our bodies against the attacks of winter.

It is claimed that ultra-violet light will grow hair in all cases except when it has died gradually on account of old age. Sunburning the scalp with ultra-violet light causes a rush of blood to the region, bringing with it the food that the starved hair roots require. If you dry your hair in the sunshine, or go bareheaded out of doors, nature gives you a free beauty treatment.

Treated by Snow and Sun

Tuberculosis sufferers in Switzerland tramp unclothed in the dazzling snow. Snow reflects ultra-violet rays of sunlight almost completely, thus giving the patients a double dose of the healing light—both direct and reflected light

Bacteria Killed in Less than a Second

Dr. W. W. Coblentz of the U. S. Bureau of Standards, with the new apparatus for measuring the germ-killing properties of ultra-violet light. Exposed to the light, bacteria found in sewage were killed in less than a second, thus explaining the power of ultra-violet rays to cure disease

Ultra-violet light penetrates the skin to a depth of only one-tenth of an inch. By pressing a small water-cooled lamp close to the skin, it is possible to make the light penetrate as far as one-fourth inch. This is seldom done, since the powerful light destroys the surface of the skin at the same time as it kills the germs beneath.

As a germ killer, ultra-violet light is proving effective in treating skin diseases, boils, and carbuncles. By means of curved quartz tubes it is possible to get at germs in infected parts that are inaccessible; for example, in treating tonsillitis, pyorrhea, abscesses, ringworms, or by introducing a water-cooled lamp into the inside of bones, in treatment of bone tuberculosis. Also it is beginning to be used to replace chemical germicides such as iodine, which sterilizes only the surface and has no penetrating power.

That ultra-violet light can be introduced internally is a recent and important development. For many years children have been fed cod-liver oil to prevent them from becoming bow-legged, an effect of rickets. Ultra-violet light treatment was found to be similarly effective in fighting rickets.

Dr. I. Newton Kugelmass and Dr. Irvin McQuarrie of the Yale Medical School recently announced the result of an investigation of the relation between the oil and the light. Cod-liver oil cures rickets, they said, because it actually generates ultra-violet light in the intestines. When oxygen was added to the oil (as it would be in the natural process of digestion), the oil blackened a photographic plate, screened with quartz, but had no effect when the plate was screened with glass. Egg yolk and sperm oil, also helpful in the cure of rickets, did the same thing, while substances having no value in treating rickets had no effect on the plate.

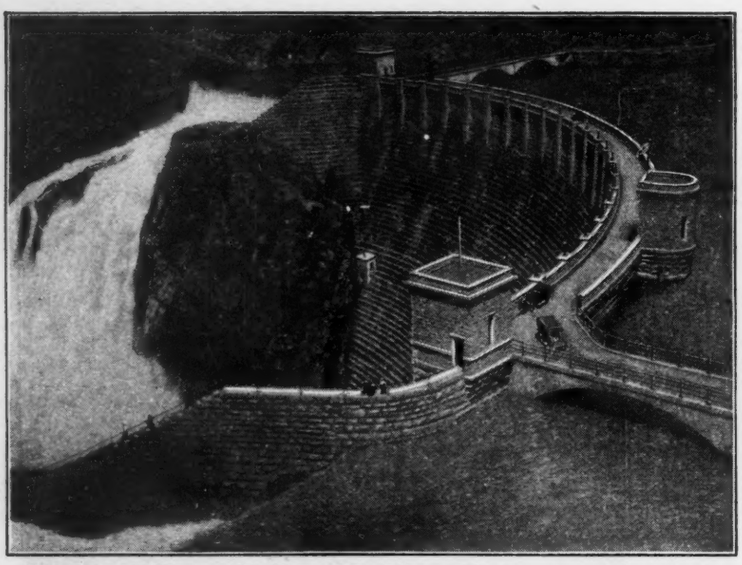
This explained the mystery of why Eskimo children rarely suffer from rickets. While thousands of children suffer from the disease in foggy climates, particularly during the winter months, supposedly on account of the lack of sunlight, Eskimo children, who live where darkness lasts for months, were not affected. Now it seems that they maintain their health through their diet, most of which contains large quantities of various fish oils.

DOCTOR A. F. HESS, of New York, has announced that he has discovered a method of making cottonseed oil and linseed oil absorb ultra-violet light. This is of great importance, for while the supply of cod-liver oil and sperm oil in the world is limited, the supply of vegetable oils is not. Doctor Hess also found that lettuce, which ordinarily has no effect on rickets, and wheat grown in the dark, after an exposure of two minutes to ultra-violet light, became active in preventing weakness in bone.

Scientists in other countries as well as America are experimenting to cause food to absorb ultra-violet light. With a method of "eating sunshine," they believe, we shall have found one of the greatest preventives of disease the world has ever known.

While startling discoveries have been made showing the effect of ultra-violet light on our bodies, commercial uses for it have been found also. Poultry producers will undoubtedly benefit from an experiment made by Drs. J. S. Hughes and L. F. Payne of Manhattan, Kan. Like bone-making, egg-laying requires utilization of lime. Exposing hens once a day for 10 minutes to an electric-lamp source of ultra-violet light caused them to lay four times as many eggs as those that did

(*Continued on page 130*)



The Roosevelt Dam on Salt River, Ariz., built in 1911, is an outstanding example of the curved dam built in modern times. It was built by the U. S. Government, and is 280 feet high, 1125 feet long, and has storage capacity of 513 billion gallons

The Upper Otay Dam near San Diego, Calif., only four feet thick at the top; yet it withstood a severe flood in 1916. It holds 650 million gallons of water

Engineers Will Burst $100,000 Dam

Startling Test to Measure Safety of Arch Construction

By Truman Stevens

ONE of the most startling scientific tests ever conceived soon will be made not far from Fresno, Calif., when the Engineering Foundation, the joint research organization of the American Societies of Civil, Mining, Metallurgical, Mechanical and Electrical Engineers, will construct a full size arch dam for the sole purpose of causing it to burst under pressure of the water it impounds.

The object of the test is to determine the weakest parts of dams of this type of construction and their manner of failure, for the purpose of ascertaining how to build dams of maximum safety, yet with minimum thinness of construction and consequent economy of material. The experiment will cost $100,000.

Will It Hold?

This diagram shows the daringly thin proportions of the proposed experimental dam. It is only half as thick as the four-foot Upper Otay Dam

Arches of stone or concrete are familiar sights in bridges. Relatively few persons, though, have seen arches stood on end to back up the water of a stream so as to create an artificial lake or reservoir for power development, water supply, irrigating arid lands, or regulating floods. Dams of this type, however, have been constructed for more than 300 years. The oldest known, the Almanza, was built in Spain before 1586 and is standing today. The Roosevelt Dam in Arizona is an outstanding example of the curved dam built in modern times.

Some of these dams are low, but a few exceed 200 feet in height above the stream bed. Some are very thick, others extremely thin. Very few have failed, and they because of faults of the foundation chosen. From this circumstance the question naturally arises: If the thin dams were strong enough, were not large sums of money wasted on the thick ones? This is one of the questions that the impending experiment in California aims to answer.

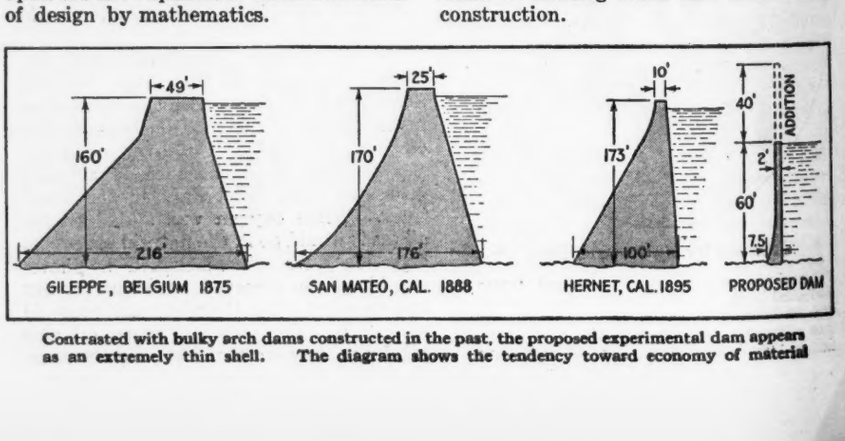
The other question—safety—undoubtedly is the first consideration in dam construction. A great volume of water let loose at high velocity through the failure of a dam may be more quickly destructive than fire. Furthermore, the loss of the water stored by the dam may be disastrous in itself because it is needed for supplying a community, for irrigating crops, or for generating power. In the past, engineers have been dependent for their knowledge of dams upon the results of experiments with small models in laboratories, and upon the development of various methods of design by mathematics.

The California experiment will furnish engineering science with its first opportunity to perform needed tests on an adequate scale.

Through the Department of the Interior and the Southern California Edison Company an ideal site and suitable facilities have been obtained for the test dam on Stevenson Creek, a small tributary of the San Joaquin River. The creek gorge is of granite, steep and narrow, so that the reservoir will be small. A recently completed water-supply tunnel of the Southern California Edison Company is near and provides means for furnishing and controlling the water needed.

THE idea of the committee that has the experiment in charge is to approximate the most daringly thin dams that have been built, and perhaps "go them one better." Then, after many tests and measurements, an attempt will be made to break the dam in order to discover its weakest part and the manner of failure. For this purpose the dam will be extended vertically to increase the depth of water and its pressure against the dam.

Preliminary to the construction of the test dams careful measurements are being made of existing dams and dams under construction.



Contrasted with bulky arch dams constructed in the past, the proposed experimental dam appears as an extremely thin shell. The diagram shows the tendency toward economy of material

Half Million Acres Burned in a Year

How Uncle Sam Fights Forest Fires

Uncle Sam's Fire Scout on the Job

This ranger in the New Mexican Forest Reserve is searching for any telltale wisp of smoke caused by some deserted camp-fire or lighted cigarette

Three Hours after the Start

Flames, driven by a high wind, sweeping a portion of the Colorado National Forest. Every year forest fires burn an area equivalent to a 10-mile strip from New York to Denver, mostly due to carelessness

With the Eye of a Hawk

A lookout in the Black Hills National Forest, S. D., using ingenious fire-finding instrument to establish the location of a blaze. This is a most effective method of fire protection

The Fire Line

Woodsmen clearing a line of brush and debris to halt a conflagration in the Wasatch National Forest, Utah

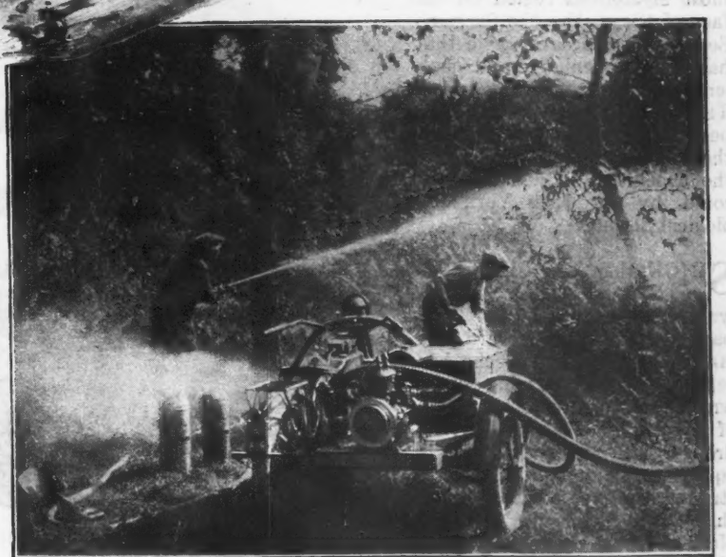
Photos courtesy U.S.Forest Service

MORE than half a million acres of national forest lands laid in waste by flames! These startling figures set 1924 down as one of the most critical years in the experience of the United States Forest Service. Growing carelessness on the part of the campers, combined with long sustained droughts are given as the cause.

Only 20 per cent of these forest fires were due to lightning. Four-fifths were traced to human causes. Smoking, especially of cigarettes, campfires and incendiarism were the chief of these, with smoking by far the most serious.

Fires burning more than 1000 acres in a single day were not infrequent. During the year flames destroyed or damaged enough timber to build five-room houses for the entire population of San Francisco, Calif., Denver, Colo., or Washington, D. C.

In the last six months of 1924 the government spent $1,600,000 in fighting fires, outside of the cost of forest officers' salaries. Lookouts stationed on high ground, airplane patrols and fire-fighters are on the job night and day; yet in spite of their best efforts, the yearly damage from forest fires, due mostly to public carelessness, is more than $16,000,000!



A new portable fire-fighitng outfit, with powerful pump and long hose carried on a motorcycle sidecar, is particularly adapted to use in rough forest lands. The water can be pumped from any available stream. The outfit also includes two chemical tanks, shovels, spades, axes, and other fire-fighting implements. Usually two men constitute the operating force, one man riding on a back seat

Exploring a Jungle in Mid-Atlantic

Science's Thrilling Quest into the Sargasso Sea Brings to Light Fish with Fingers, Hair, and Feathers; Ocean Insects Never Seen Before

By Raymond J. Brown

IN AN odd, basket-like contrivance of steel, suspended just above the water from the bow of a wooden steamship in mid-Atlantic, a tall, slim man in the rough clothing of a common sailor recently stood brandishing a long-handled scoop net. He was peering intently into the dark, weed-infested depths through which the ship was creeping, quite as a boy standing in the bow of a flat-bottomed rowboat might scan the bottom of a shallow inlet in search of crabs.

Suddenly the man bent forward, thrust his net down swiftly, swept it through a wide arc and drew it forth again. In the meshes, as he raised the implement aloft, was struggling an outlandish creature of many hues with a dozen tapering tentacles wriggling from its shapeless body.

With this catch what is possibly the most spectacular and thrilling scientific expedition of the present day may be said to have actually begun. The tall man was the distinguished scientist and explorer, William Beebe. The ship from which he was conducting his queer fishing was the *Arcturus*, a 280-foot, 2475-ton vessel, especially equipped for the exploration of the most mysterious region on the face of the earth—the Sargasso Sea, a weird ocean jungle that has been an enigma and challenge to science for centuries. The strange fish that had just been drawn from the sea was the first specimen collected by the expedition, which is sponsored by the New York Zoological Society.

SINCE then a wealth of biological specimens has rewarded the efforts of the little band of scientists aboard the *Arcturus*. By radio Beebe has reported many amazing finds, wrung from the reluctant grasp of Neptune by the nets and dredges with which his vessel is equipped. Among them is a strange fish covered with scales that are like hair or feathers. Neither Beebe nor Dr. William K. Gregory, of the American Museum of Natural History, who is a member of the expedition, can classify this creature as belonging to any known species. Apparently it is entirely new to science.

Other valuable discoveries are fish with fins like hands; insects of which science had not heard previously that walk 3½ miles deep on the ocean bottom; sponges with skeletons like glass. With each withdrawal of the trawling-nets odd creatures like these have been taken from the depths.

The Sargasso Sea, famed in fable and story as the "graveyard of the Atlantic," and the supposed vanishing place of the mythical continent of Atlantis, is a huge oceanic lake between Bermuda and the Virgin Isles, of approximately 400,000 square miles in area, or almost 10 times as large as New York State.

THE sea is inclosed by the twenty-fifth and thirtieth parallels of north latitude, and the thirty-eighth and sixtieth meridians of west longitude. Actually it is a great whirpool, formed by the Gulf Stream and the main equatorial current that flows westward across the Atlantic from Africa to South America. It circulates but slowly; yet into it is drawn irresistibly the débris that floats along on these great ocean rivers—seaweed, driftwood, animal carcasses, and vegetation from the shores; the hulks of lost ships, dead sea creatures, refuse from ocean-going vessels. All the flotsam of the Atlantic, it may be said without undue exaggeration, eventually reaches the Sargasso Sea, there to swim sluggishly about until it decays and sinks to the bottom.

It is this accumulation of rotting organic matter that has made the Sargasso Sea the garden soil of the ocean, and hence of peculiar interest to science. In it float enormous grassy islands of the peculiar yellowish seaweed called "Sargassum," which derives its nourishment from the sunken ocean garbage, quite as the plants of the land thrive in ground that is enriched by decayed animal and vegetable waste. Beneath the waters, feeding on the refuse from sea and land, live the strangest creatures that exist on earth. Columbus, seeking lands to the westward, thought he had discovered them when he ran into this swirling marine forest.

MARINERS crossing the Atlantic have for centuries avoided the Sargasso Sea. Tradition says that many a ship, becalmed there, or unable to cleave its way through the thick floating grass, has floated round and round in those deadly

Enters Neptune's Graveyard

NOT since the days when young Darwin cruised the seas in the *Beagle* has there been a more picturesque figure in scientific discovery than that of William Beebe, curator of ornithology of the New York Zoological Society, who now has ventured into wildernesses of the Atlantic that long have challenged science.

Readers of POPULAR SCIENCE MONTHLY are well acquainted with Beebe's previous romantic adventures to the desolate Galapagos and into British Guiana. The story of his present venture is equally fascinating. While his good ship *Arcturus* may never take its place beside the *Beagle* in scientific importance, it promises an amazing wealth of new discovery as it plows among the weeds of the Sargasso Sea.

William Beebe
Scientist, explorer, and writer

Examining the First Haul

Two members of the Beebe expedition, Mrs. C. J. Fish (right), a government representative, and Miss Lillian Segal, a biological chemist, are shown here aboard the *Arcturus*, examining the first haul of strange creatures from the Sargasso Sea. Many remarkable specimens already have been caught

waters until its skeleton at last joined the thousands of others that found their graves beneath the Sargasso's tangled surface covering.

The biological importance of this strange sea meadow, however, is enormous. Because of the discoveries made in and around it by previous scientific expeditions, we have our whole conceptions and knowledge of the strange dwellers of the waters of the Atlantic. The Sargasso Sea furnishes the food supply of practically the entire range of marine inhabitants.

IT IS to coordinate and add to the knowledge gained by previous expeditions that the little group of scientists aboard the *Arcturus* sailed to these treacherous waters.

The *Arcturus* has been admirably equipped for the fascinating adventure on which its passengers embarked. Besides the movable railed platform from which Beebe accomplished the first catch of the expedition, there is a runway with a handrail around the outside of the hull, from which fish or other creatures may be harpooned or netted, or observations made.

A series of searchlights, the beams of which can be turned in any direction horizontally or vertically, facilitates observations at night. The masts of the ship have been equipped with crow's-nests so that hunting-grounds not visible from the deck or the runway may be searched for.

Part of the wooden bottom of the ship was removed and plate glass substituted, so that, with the aid of strong lights, observations can be made of the life beneath the surface, both plant and animal. There are steel platforms, which can be raised and lowered on davits, and which permit divers to descend into the sea to observe and to seek specimens.

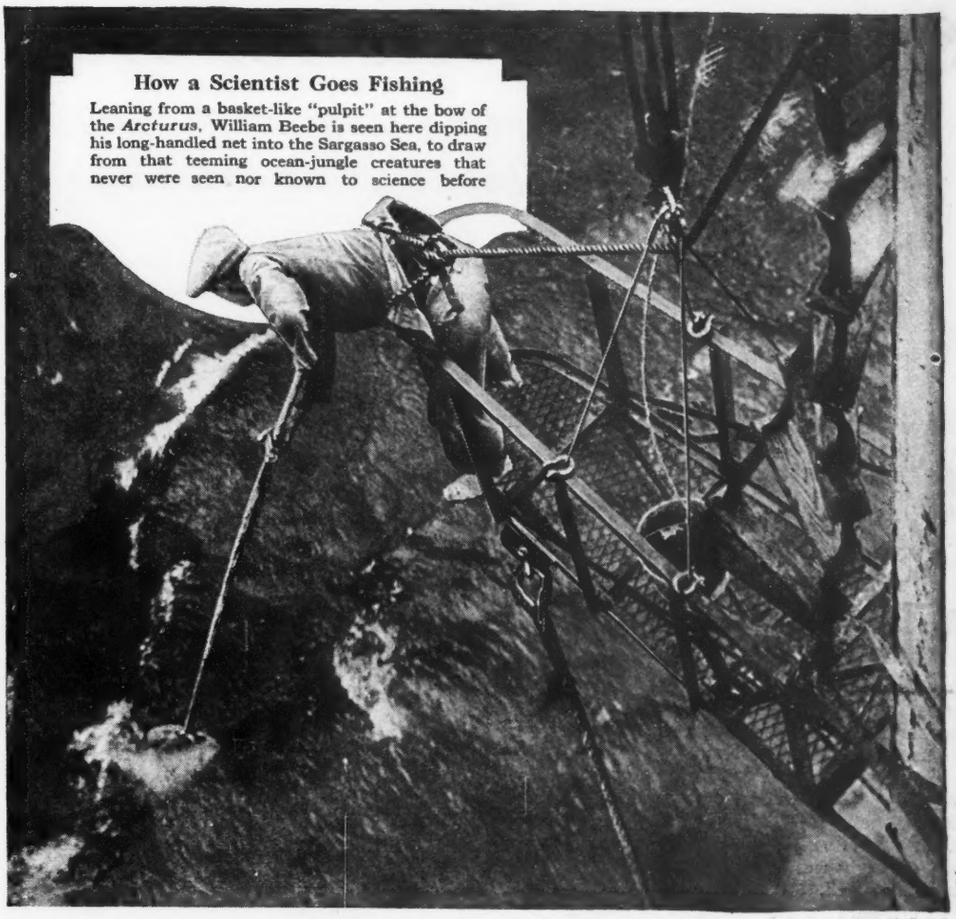
Numerous small boats, some with glass bottoms, are carried for scouting expeditions over the floating meadows. There are aquariums, tanks, and wells for live specimens, and a darkroom in which the strange luminous fishes that inhabit the ocean's bottom may be studied. The propeller of the vessel is fitted with a guard to prevent entanglement of sea growths.

Miles and miles of cable are carried for the dredging operations that already have yielded specimens of enormous scientific interest. Three and a half miles was the deepest to which the dredge had descended at the time of this writing, but the *Arcturus* is equipped to make soundings twice as deep.

Half-inch cables, made up of 133 separate wires, are used for the dredge, which is hauled along sledlike on runners on the ocean bottom, and for the great trawling-net. Just how big a job it is to dredge the depths of the ocean is shown by Beebe's wirelessed report that it takes an hour to let the cable down a mile and another hour to haul it in again.

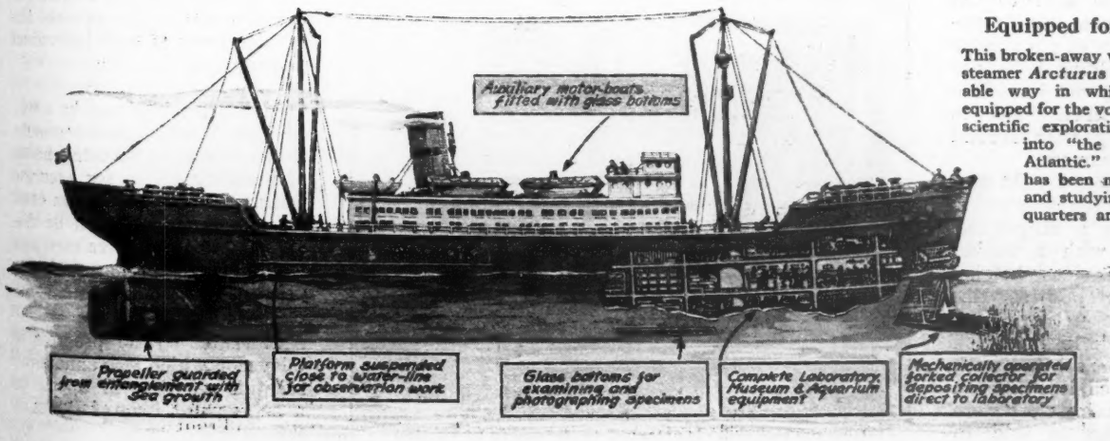
One of the announced purposes of the expedition is to endeavor to obtain a specimen of the giant squid, or cuttlefish, most dreadful of all sea creatures. This is the huge, ten-armed monster that has figured so often in tales of the sea.

The cruising range of the *Arcturus* is 30,000 miles, and she will remain at sea for a half-year at least, touching at shores where specimens are likely to be found. American museums and aquariums are likely to be enriched materially by this expedition, which promises to achieve results of greater importance even than those of Beebe's previous recent expeditions to Galapagos and British Guiana, which have been described in POPULAR SCIENCE MONTHLY.



How a Scientist Goes Fishing

Leaning from a basket-like "pulpit" at the bow of the *Arcturus*, William Beebe is seen here dipping his long-handled net into the Sargasso Sea, to draw from that teeming ocean-jungle creatures that never were seen nor known to science before


Auxiliary motor-boats fitted with glass bottoms
Propeller guarded from entanglement with sea growth
Platform suspended close to water-line for observation work
Glass bottoms for examining and photographing specimens
Complete Laboratory, Museum & Aquarium equipment
Mechanically operated forked collector for depositing specimens direct to laboratory

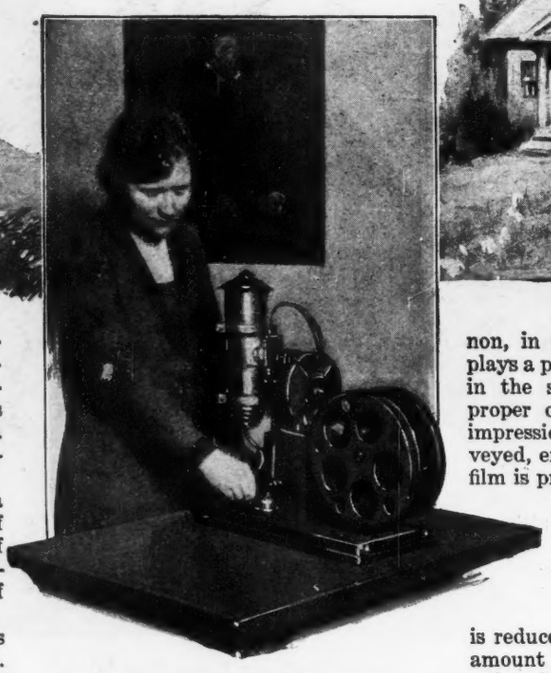
Equipped for Adventure

This broken-away view of the wooden steamer *Arcturus* shows the remarkable way in which the vessel is equipped for the voyage of fascinating scientific exploration and discovery into "the graveyard of the Atlantic." Every provision has been made for observing and studying sea life at close quarters and making photos

Courtesy the New York Sunday World

Six-Reel Movies for Every Home

Inventor Claims New Method Simplifies Film-Making for the Amateur



The projecting machine is simple to operate, frequent changes of film being eliminated

MANY novel features are incorporated in a new method of producing moving pictures for non-theatrical use developed by Thomas Armat, of Washington, D. C., who was a pioneer in the development of the moving-picture projecting machine.

The new process involves a camera, a projecting machine, a new kind of moving-picture film, and new ways of taking and showing pictures, which permit one-eighth of the usual quantity of film to be used.

In ordinary moving-pictures 16 images are photographed and projected a second. Mr. Armat has succeeded in cutting the number of pictures made and shown each second to eight. This he has accomplished by making each "frame," or separate picture, do double duty, for instead of each frame containing only a single picture, it contains two.

In the conventional movie camera the movement of the film is controlled automatically so that the film is halted momentarily while each exposure is made. By the Armat process the film is halted for double the usual time, and two pictures are made, one on top of the other.

When the film made by this process is projected, each frame is held stationary in the projector for double the usual time—an eighth of a second, approximately, instead of a sixteenth—and the light in the projector lamp is interrupted. The result is that the same frame is seen twice, and here comes a remarkable feature of the process. Through an optical phenomenon, in which the imagination possibly plays a part, the eye views the two images in the same frame separately, and in proper order, the result being that an impression of continuous action is conveyed, exactly as happens when ordinary film is projected at normal speed.

This one feature would permit the amount of film necessary to show any action to be cut to half. The Armat film, though, is half the width of standard film, and each image is reduced one-half in length. Thus the amount of film necessary for a picture is reduced to one-eighth the quantity ordinarily used.

Prints can be made on the Armat film from standard negatives, the conventional feature picture of five or six reels requiring only a single one-thousand-foot reel of Armat film, which once placed in the projector will run for an hour without further attention of the operator.

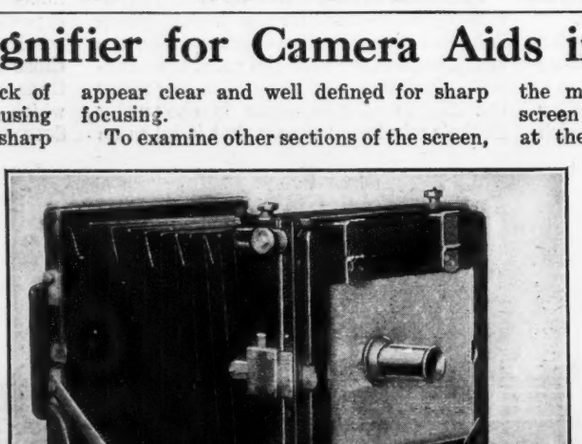
The camera invented by Mr. Armat is a compact, simple, light machine that can be operated by any one without special training or practice.

Suction Magnifier for Camera Aids in Focusing

TO OVERCOME the drawback of having to use a large focusing cloth in order to obtain a sharp picture, a magnifier has been invented that is held to the focusing screen by suction. Ordinarily, working with a magnifier is difficult. Holding it in one hand leaves only one hand free to make adjustments and to pull the focusing cloth around the back of the camera.

The new device, a light aluminum tube less than three inches long, containing a magnifying lens, is fitted with a rubber suction cup. Besides holding the magnifier in position, this cup protects the section of the ground glass under examination from outside light so that work can be done as well, it is claimed, as if a large focusing cloth were used. The image is said to appear clear and well defined for sharp focusing.

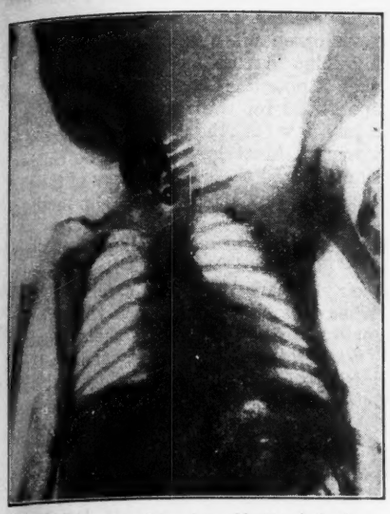
To examine other sections of the screen, the magnifier is simply slid along the screen to a new position. A screw thread at the eyepiece end makes it possible to adjust the distances of the lens from the screen to suit the eyesight of the user and meet the requirements of each individual photograph.



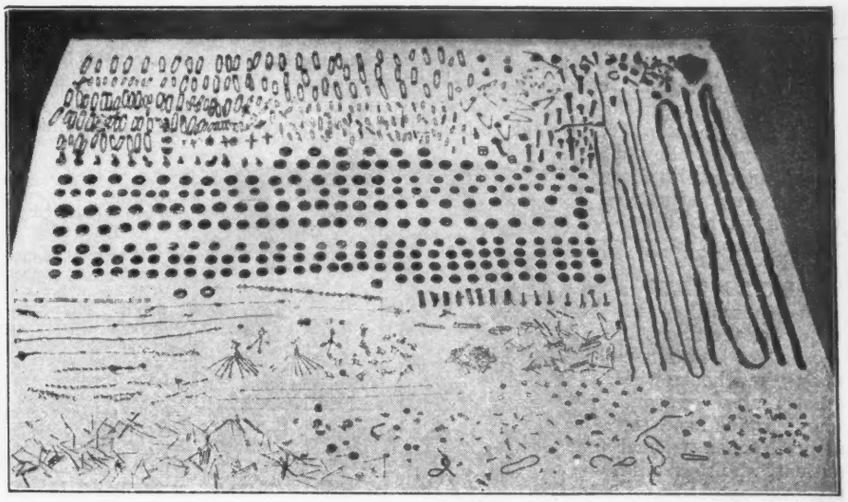
How the magnifier is attached to the screen by suction

THE magnifier can be used, also, with hand cameras that often have focusing hoods of insufficient size for accurate work. Used with a reflex camera, the long hood can be discarded and the camera used at a higher level, giving a better point of view.

AN ARTICLE on the progress of television, which was announced for this month, will appear in a subsequent issue of POPULAR SCIENCE MONTHLY.



X-ray showing safety-pin and button lodged in the throat of a 10-day-old baby. These two articles were removed in one minute



All these objects—nearly a thousand in number—were removed recently from the stomach of a 15-year-old girl in Saginaw, Mich. They include safety-pins, earrings, watch chains, coins, metal street-car tokens, brooches, nails, laces, and ribbons, weighing nearly four pounds altogether

Strange Things Folks Swallow

The amazing variety of dangerous objects found in human stomachs—How they get there and how they are removed—Precautions to safeguard yourself and your children

By Ada Patterson

IN HOSPITALS in many parts of the United States are museums where are displayed an amazing assortment of articles, mostly useless. There are carpet tacks, pins, needles, fragments of combs and eyeglass frames, thumbtacks, bits of wire, shoe laces, pieces of bed springs, paper clips, metal tags, washers, curtain hooks, cartridges, shot, safety-razor blades, teeth both natural and false, spoons, hairpins, phonograph needles, safety-pins, fragments of bone, watermelon and other seeds, coffee beans, pieces of solder, beads strung and unstrung, and coins, the last almost entirely of denominations less than half a dollar.

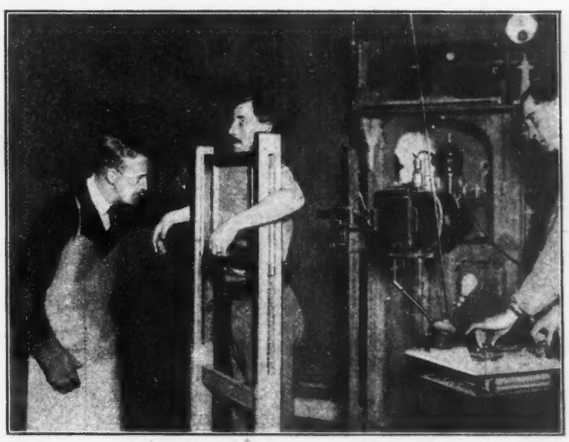
Such articles, you would say, would make only a poor display in a hospital museum case. They do. At least, the exhibition I saw recently in the Jefferson Medical College, Philadelphia, Pa., was singularly uninspiring in itself. It happens, however, that virtually every one of the thousands of articles displayed there and at the other similar exhibits represents a successful operation.

For these odd collections of useless hardware, vegetable matter, and trinkets are made up of the queer things people swallow.

People take these singularly indigestible objects into their systems for a variety of reasons. A small number passes into the stomach, throat or lungs by accident. The most careful person is likely to swallow a peach or prune pit, a small bone, a pebble, or bird-shot with his food and not realize that he has done so.

Most of these foreign bodies that are swallowed, however, are taken by intent. The professional swallowers—"human ostriches" they call themselves—who entertain in the side shows at county fairs have contributed many weird additions to the odd surgical museums.

Many other persons swallow sharp objects—nails, needles, knives, and razor blades—with suicidal intent. Other habitual "swallowers" are mentally deranged, or suffer from some peculiar physiological condition that causes them to enjoy the irritation hard or sharp objects set up in their internal organs. Then a great many of those who have been operated on have been infants whose careless mothers or nurses have left bright and attractive but dangerous objects within their reach.



How Swallowed Objects Are Located

Physicians using improved X-ray apparatus to determine the location of a foreign body swallowed by a patient. A surgical operation frequently is necessary to save the patient's life

DR. CHEVALIER JACKSON professor of laryngology at Jefferson Medical College, who has performed more than 1200 operations to remove from the throat, stomach, and lungs of people objects that had no business there, discussed with me recently the really amazing things that people swallow. Doctor Jackson's own museum supplies eloquent if mute testimony as to this.

"There is rarely a week goes by," he said, "that you cannot read of some person who has swallowed an almost unbelievable variety of dangerous objects. Not long ago an operation on a 15-year-old girl in Saginaw, Mich., resulted in the removal of almost a thousand things she had swallowed. These included safety-pins, earrings, watch chains, stove bolts, coins, metal street-car tokens, brooches, adhesive tape, shoe laces and bits of ribbon—almost four pounds in all.

"A professional 'swallower' at Chicago yielded 275 metal objects in an operation, the contents of his stomach including upholstery tacks, nuts, bolts, screws, a can-opener, a couple of handfuls of thumbtacks, almost a box of fair-sized nails, cartridges, safety-pins, paper clips, and coins.

"A woman in New York, who had been eating pins and needles

for years, desiring a more substantial diet possibly, at last began swallowing safety-razor blades, with fatal results.

"A needle—the first he had swallowed—killed a four-year-old boy in Newark, N. J., a few months ago, although he had previously swallowed bone buttons, bits of wood, and similar things without apparent discomfort.

"RECENTLY a Kansas City surgeon removed about 50 pieces of mattress spring, two hooks with staples attached, and four hairpins from the stomach of a woman patient, who recovered after the operation.

"These are typical cases of persons who swallow things intentionally. Not long ago I heard of an accidental case in Toledo, Ohio, which supplies a striking instance of how easily carelessness may lead to disastrous results. A saleswoman in a department store was pinning some merchandise together and had 16 pins in her mouth—a dangerous practice, of course. A fellow clerk offered her a piece of candy, and unthinkingly she began to eat it. She coughed, and of course swallowed both candy and pins.

"About 90 per cent of the cases of foreign bodies getting into the air and food passages accidentally probably are avoidable. Bolting of food, a common fault of Americans, is responsible for many of them. Carelessness in preparing food is responsible for many more. It is nothing less than criminal to serve food containing fragments of nut shells, egg shells, oyster shells, crab shells and so on, or to permit chips from food containers, splinters from flour or sugar barrels, or solder from tin cans to get into food. When a fruit jar, jelly glass, or similar container breaks or chips in opening, the contents should be strained or thrown away.

"PEOPLE are careless, too, in serving to children, invalids or aged persons food that contains bones, watermelon seeds, orange seeds, lemon seeds, cherry, plum, prune or peach pits or the stems of fruits. Many kinds of ordinarily harmless candy are a source of grave danger to young children. A child less than two years of age has no grinding teeth, and consequently is no more able to dispose of a piece of peanut candy than it could eat an iron bar.

"If a child of that age gets a piece of peanut into his mouth, he cannot chew it. There are only three things he can do: spit it out, swallow it whole, or breathe it into the lungs. If he spits it out, well and good; if he swallows it whole, it will pass into the stomach to make trouble. If he breathes it into the lungs, it will lodge there and lacerate.

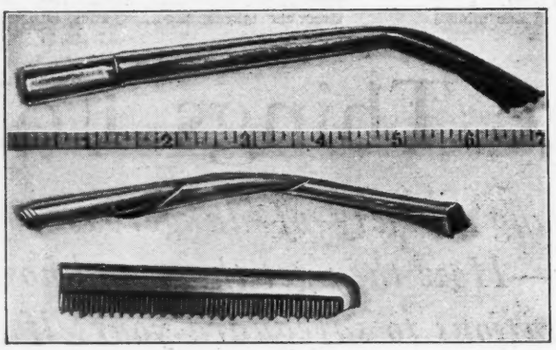
"False teeth are frequently swallowed, often causing choking or irritation of the stomach or intestines that results fatally. Any wearer of false teeth whose plate becomes damaged or ill fitting should take it to his dentist for repair immediately.

How Did She Do It?

A Cincinnati woman recently complained of pains in her stomach. Physicians, after an X-ray, removed from her stomach two pieces of brass curtain rod, one measuring 7½ inches long, the other six inches; also a piece of comb three inches long. The woman did not remember when she swallowed them!

Swallows Toy

A little tin auto belonging to 18-months-old Johnny Fitzpatrick of Brooklyn, N. Y., disappeared mysteriously. The upper picture shows how the X-ray found it in the esophagus



"One patient here was a woman who swallowed a fragment of tooth in a dentist's chair during a fit of coughing that followed the extraction. Neither she nor the dentist was aware of what had happened. Later, though, she developed an almost incessant cough. At a consultation of physicians her trouble was diagnosed as an abscess in one of her lungs. The X-ray, however, disclosed the tooth fragment that had lodged in her lung. The bit of tooth was removed by operation, and the woman recovered.

"Women often have a habit of holding coins in their mouths. It is remarkable, though, that of 130 or more operations for the removal of swallowed coins, few of the patients have been women. Most have been little children who suffered the consequences of the bad example shown them by their mothers.

"THE rest of our small patients have swallowed harmful objects because their mothers have been careless enough to leave within their reach things small enough to be placed in their mouths.

"A child seven years old carried a large upholstering tack about in his right lung for two years. Physicians said he was tubercular. The X-ray, however, located the tack."

Doctor Jackson is the inventor of the bronchoscope, a device that has facilitated greatly the removal of foreign objects from the throat or windpipe.

This instrument consists of a long, flexible tube, within which is a series of mirrors that reflect an image of the object that must be removed. Illumination is supplied by a small electric light.

The patient is laid upon a table, and his head and neck are so placed that mouth, throat, and windpipe are in a straight line. The operating surgeon inserts the tube in the patient's throat, slips his forceps down into the tube, guiding his movements by the reflection in the mirrors, and withdraws the object that has been swallowed. This operation can be performed without an anesthetic.

An 18-months-old baby in Brooklyn not long ago swallowed a tiny lead automobile. The child was hurried to a hospital, where an X-ray examination revealed the toy in the upper part of the child's esophagus. The bronchoscope was worked gently down the throat until it covered the toy. Then the tube was carefully drawn out, and the automobile came with it.

Nature makes strenuous efforts to protect foreign bodies from doing harm when they find their way into the respiratory system or digestive tract. Thus, post-mortem examinations of many habitual "swallowers" have shown layer upon layer of tissue grown about the objects and hiding them. This is a process analogous to that which produces calluses on the hands, or that which causes a wounded oyster to produce a protecting pearl.

THIS, however, gives no assurance of safety to any one who has swallowed something that does not belong in his mechanism. Nature frequently fails in its efforts to protect. The object may become embedded in an organ and cause a malignant growth. It may choke the swallower. It may cause lameness, or blood poisoning. If an alien substance gets beyond the throat, we should hasten to a hospital or to a physician who has an X-ray apparatus.

To Avoid Trouble—

DON'T eat or drink in the dark.

Keep small objects out of the reach of small children.

Never put pins, coins, pencils, or smaller objects in your mouth.

In preparing food, be careful to keep foreign bodies out of it.

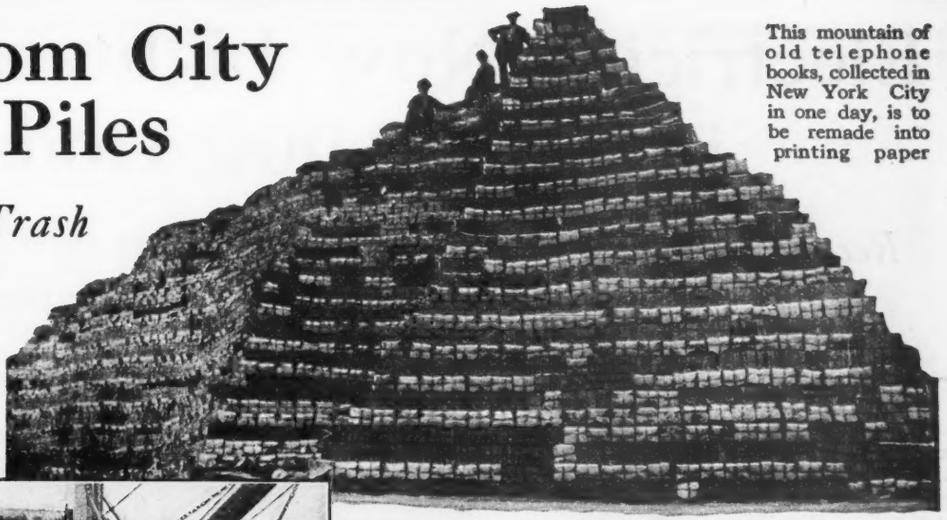
If you require glasses to read, wear them also when you eat.

When some instrument, such as a physician's thermometer, is placed in your mouth, be careful not to cough.

These precautions against swallowing foreign bodies are urged by Dr. Chevalier Jackson of Jefferson Medical College, who has performed more than 1200 operations to remove objects from throats and stomachs.

Profit from City Junk Piles

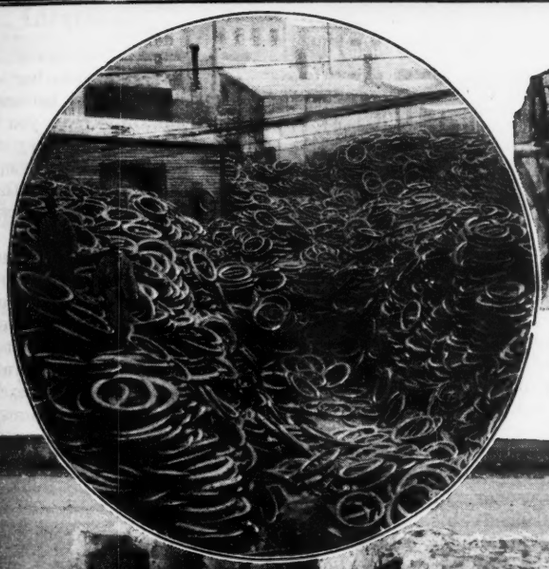
How Your Old Trash Is Salvaged



This mountain of old telephone books, collected in New York City in one day, is to be remade into printing paper

Thousands of old horseshoes are turned into steel daily. This pile of 900,000 shoes, at Worcester, Mass., is said to be the world's largest

DID you ever wonder what happens to all the trash thrown out of the homes, offices, and workshops of our big cities—the empty bottles, the discarded newspapers and magazines, the scrap iron and worn-out automobile tires? The pictures on this page tell the story, a story of how mountains of junk are salvaged and turned back to profitable uses. In New York City alone, the Street Cleaning Department disposes of more than 10,000,000 cubic yards of refuse annually. Every year, city trash heaps yield millions of dollars in reclaimable materials



At left: A $20,000 pile of 150,000 old auto tires in Boston. They go into the making of rubber boots

Above: Crating unbroken, empty milk bottles, salvaged from New York dumps, for shipment to milk companies

Part of New York's enormous daily crop of old newspapers, packed in bales on a Hudson River pier. They go to manufacturers to be made into more paper

Electricity Now Lightens Labor in 13,000,000 Homes

Recent Survey Shows Surprising Progress in Wired Lighting and Household Appliances—New Contributions to Science

THE men you will find in commanding positions today are men who are well-informed—who have at their disposal a practical, working knowledge of current developments, not only in public affairs, but in the field of scientific discovery and invention.

It is to help you keep pace with the rapid advance of science that we publish here a résumé of the month's important additions to the world's useful knowledge.

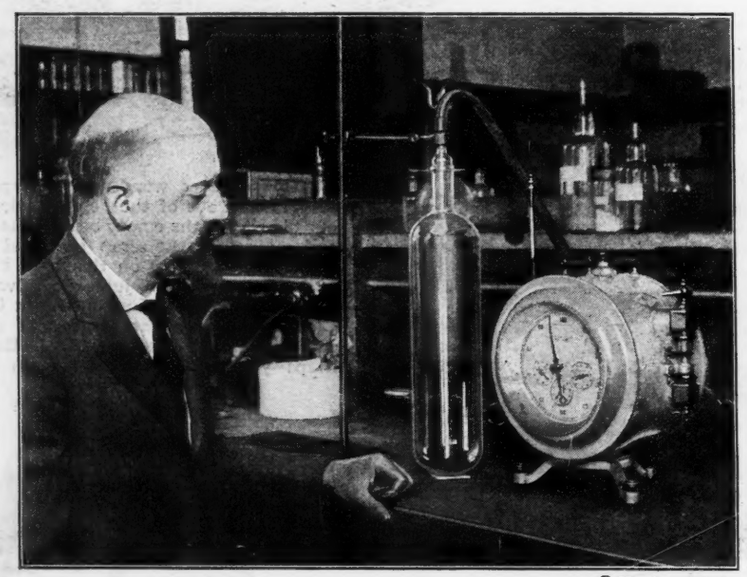
Electricity in the Home

TWENTY-FIVE years ago, a home that was wired for electric light was enough of a novelty to be the subject of comment in the neighborhood. Now more than half of the 26,000,000 homes in the United States use electricity, not only for lighting, but for a wide variety of household appliances, a recent survey shows.

In this the West, particularly the Pacific Coast, leads by a wide margin. Of almost 2,000,000 homes on the Western Coast, 85.7 per cent are wired. Utah leads all other states, with 98.2 per cent of its homes electrified, and California is second with 96.5 per cent.

Tennessee, Kentucky, Alabama, and Mississippi, grouped as the East South Central states, appear to use electricity least, 22.2 per cent of about 2,000,000 homes being equipped electrically. About 27 per cent of the 3,200,000 homes in the nine states making up the South Atlantic group use electricity, while 53 per cent of the 5½ million homes in New York, New Jersey, and Pennsylvania are wired. In New England 67.4 per cent of all homes use electricity. The Rocky Mountain states have a little less than a million homes, almost half of which are wired.

Many factors, of course, govern the use of electricity in homes. The relative availability of electricity possibly is the chief one; also states where many new homes have been built in recent years are bound to be heavy users since most new homes are wired for electricity as a matter of course. And yet some of the older states are well in the forefront, as is shown by the individual and collective figures given above.



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Newest Vacuum Bottle Is Virtually Heat-Proof

Three times the insulating efficiency of the ordinary vacuum bottle is claimed for a new type of vacuum container recently designed by Dr. C. W. Kanolt, physicist of the U. S. Bureau of Standards at Washington, D. C. He is shown here with his invention. The bottle, said to be virtually heatproof, is used for holding liquid gases at extremely low temperatures in laboratory experiments. It is proof against the cold as well

Noise-Maker Aids the Deaf

IF YOU have ever tried to carry on a conversation on a railroad train, you probably appreciate how difficult it is to make yourself heard above the rumbling of the wheels. Deaf persons, however, find their hearing improved by certain noises similar to the roar of a train. These sounds seem to set up vibrations in the ears, rendering certain auditory nerves sensitive so that sounds ordinarily inaudible are heard.

Now Dr. Byron E. Eldred, well known engineer and inventor, of New York City, has utilized this principle in a device to aid the deaf. His machine consists of a box, which, when an electric current is introduced, produces sounds not unlike the rumble of a train. These vibrations are carried to the ears of a deaf person, and carry with them, according to the inventor, the vibrations of other sounds that ordinarily the deaf person cannot hear.

Leading ear specialists who have seen the device demonstrated say it does not cure deafness, but that it opens interesting possibilities for aiding the deaf, particularly those who suffer from certain affections of the inner ear.

Seashore Undertow a Myth?

IF YOU are one of those persons who fear to go surf bathing because of the undertow, you will find some encouragement for the coming summer in a recent statement of Dr. W. M. Davis, emeritus professor of geology at Harvard University.

Doctor Davis says there is no undertow. The belief that there is a strong bottom current to carry bathers away from the shore, he says, is a myth that emanated from the excited imaginations of persons unused to

New Sound Filter May Improve Loudspeakers

An invention that may prove extremely valuable in the improvement of radio loudspeakers, talking machines, telephones, automobile mufflers, and similar appliances, is known as an acoustic filter. It is said to permit only certain sounds to pass through it. The inventor is Dr. G. W. Stewart of the University of Iowa laboratory, who based the idea on his discovery that sound waves can be made to interfere with one another in such a way that only desired tones will be transmitted

the surf after being buffeted by the waves.

When a wave rolls up to the shore, Doctor Davis says, naturally the water rolls back again from the sloping beach, sometimes with force sufficient to sweep a person whom it catches unaware off his feet. Then, if the bather is inexperienced, he is likely to be tumbled around by succeeding waves and to believe that he has been carried along by a current, when as a matter of fact he has scarcely moved.

New Marvels of the Movies

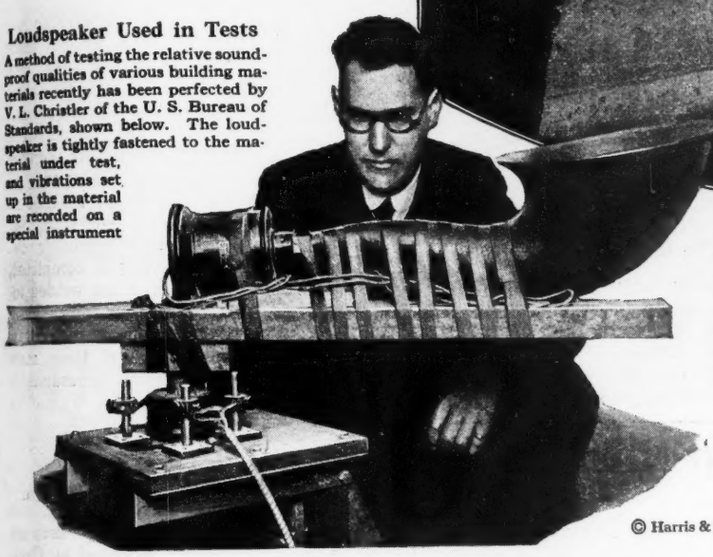
PERSONS whose memories go back to the early days of the movie craze will recall that a large proportion of the films shown in America at that time were imported, particularly from France. French moving-pictures are seen in this country only rarely now, yet France still continues to make substantial contributions to moving-pictures, particularly on the technical side.

Two recent reports from that country are illustrative of the fact.

One has to do with the invention by M. Daponte of a method of projecting pictures in relief by adapting the principle of the stereoscope to the screen. The subject is photographed in duplicate by means of a special double camera. The resulting two negatives then are printed on a single positive, the images of one being superimposed on the other by means of a combination of lenses.

When this film is run through the special projection machine developed for the process, the pictures appear as having three dimensions, this illusion being produced by a complicated lighting system in the projector, which causes two beams of varying intensity to pass through the film to the screen. There is no distortion in the pictures, it is said, no matter from what angle they are viewed.

Even more amazing than this process is the production by a Parisian film company of a photo-drama in which all the actors are bees. The life of the bee, of course, has been shown in the films before, but this astounding film has a real dramatic plot, with a bee hero, heroine and villains and a whole hive full of "extra" bees for "atmosphere" just like the conventional Hollywood production.



Loudspeaker Used in Tests

A method of testing the relative sound-proof qualities of various building materials recently has been perfected by V. L. Christler of the U. S. Bureau of Standards, shown below. The loud-speaker is tightly fastened to the material under test, and vibrations set up in the material are recorded on a special instrument

Testing Bodily Effects of Temperature

To determine the physical effects of extreme temperatures on workers in factories and mines, scientists of the American Society of Heating and Ventilating Engineers are conducting a remarkable series of experiments in cork-line test chambers at Pittsburgh, Pa. These rooms are equipped with elaborate instruments for cooling, heating, washing, drying, and measuring the atmosphere. Effects on the body of exceedingly humid atmosphere are determined by an analysis of the subject's breath

© Harris & Ewing

Predicts Winged Autos

HERE is a word picture of the motor-car of the future as presented by Prof. A. M. Low, of England:

A cigar-shaped body, completely inclosed. Instead of fenders, wings, so that the car can fly whenever conditions warrant. An exceedingly powerful motor, capable of driving the car at a hundred miles an hour or more on the ground and at airplane speed in the air.

A hundred miles an hour, according to Professor Low, will be merely normal touring speed for this vehicle, and all cars will be able to travel at that speed without danger, because the highways will be broader, and laid out scientifically to eliminate cross traffic.

Is Goiter Infectious?

A YEAR or so ago medical authorities were generally agreed that goiter was a disease confined to certain sections of this country, and caused by a lack of iodine in the drinking water of the regions where it was common. According to Dr. E. P. Sloan, retiring president of the

(*Continued on page 131*)

How Much Science Do You Know?

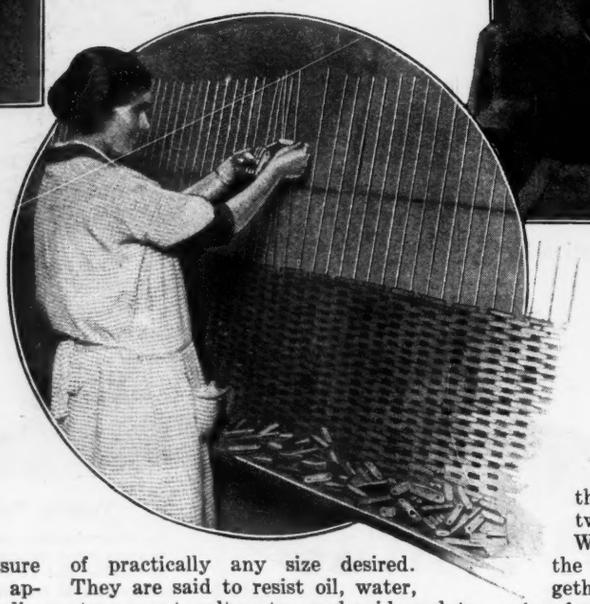
FROM hundreds of queries that have been received from our readers during the month, the following dozen questions were selected. How many of them can you answer?

Write down the answers as best you can, then turn to page 132 and see how nearly you were right.

1. Why does a blow on the head make one see stars?
2. Why are there so few green flowers?
3. What is the difference between gasoline and kerosene?
4. Are the Rockies growing higher?
5. Why does the color of the eyes sometimes change with age?
6. What causes a short circuit?
7. Why do some soaps float?
8. Why does water in the bottom of a double-boiler prevent the burning of food in the top?
9. Is a radio head phone different from an ordinary telephone?
10. Why do worms come out after a heavy rain?
11. Why is the earth round?
12. Why does fast music make you feel more active?

Rubber Carpets Made from Old Auto Tires

The ingenious new mechanical processes by which old tires are converted into floor mats are shown in these three pictures. First the tread is cut from the tire wall by the machine at the left. Next, small blocks are cut from the fabric (right) and two small holes are punched in each block. Finally, the blocks are strung like beads on steel rods (below) and the rods are welded into a mat



BY THE perfection of an ingenious method of manufacturing floor-coverings from old, worn-out automobile tires, a Seattle, Wash., inventor recently created a thriving new industry on the Pacific Coast.

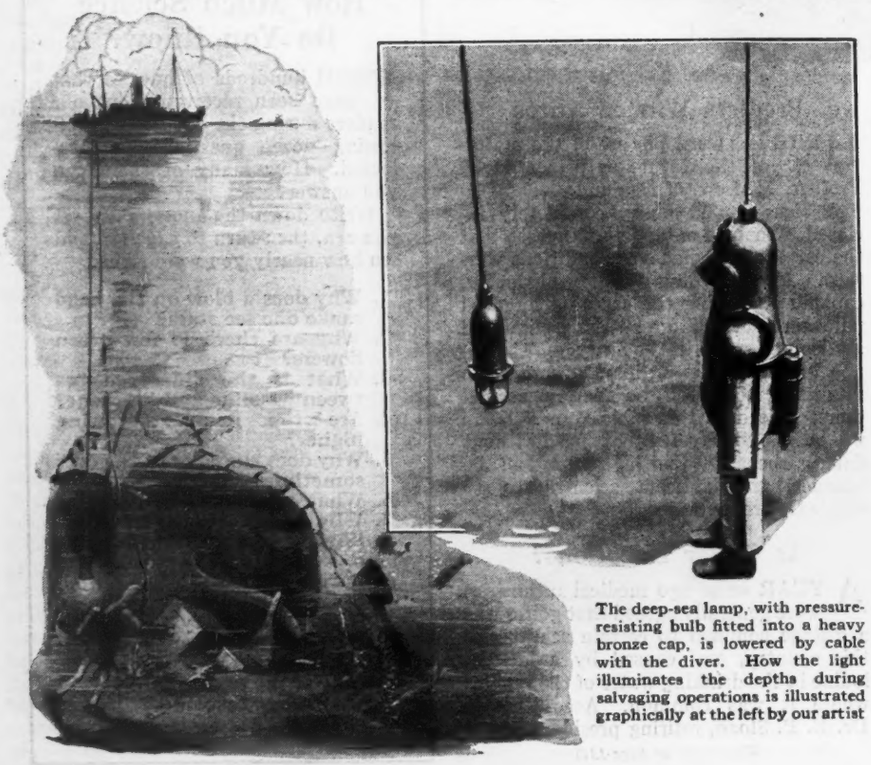
An idea of the important possibilities of his invention may be gained from an estimate of the number of discarded tires that find their way to the nation's junk piles each year. In the United States at present more than 17,000,000 motor-cars are in operation. Of this number it is estimated that about 15,000,000 are pleasure or combined business and pleasure cars. Thus, estimating that each of the pleasure cars uses four tires every two years, approximately 30,000,000 tires are discarded annually.

By the new method either fabric or cord tires can be turned into durable floor mats of practically any size desired. They are said to resist oil, water, steam, rust, salt water and acid, and to last in good shape an average lifetime.

In their manufacture one machine separates the bead, wall and tread of the tires. A second machine cuts fabric blocks about three inches long and one inch wide from the tire. The same machine punches two small holes in each block. The small rubber blocks then are slipped over U-shaped steel rods. They are stacked so that the blocks fit over spaces between blocks in the preceding row. When the weaving is completed, the ends of the rods are welded together with brass clips. The block edges form the wearing surface of the mat.

Although manufacture of these mats was begun very recently, thousands of them now are in use.

New Diver's Lamp Illuminates Ocean Depths



The deep-sea lamp, with pressure-resisting bulb fitted into a heavy bronze cap, is lowered by cable with the diver. How the light illuminates the depths during salvaging operations is illustrated graphically at the left by our artist

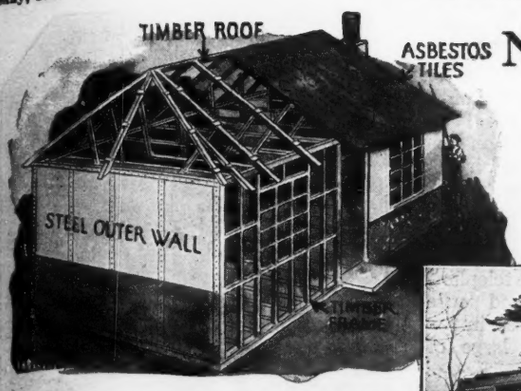
A HIGH-PRESSURE diving suit and pressure-resisting deep-sea lights, recently invented by Capt. Benjamin Leavitt of Philadelphia, make it possible, it is claimed, for salvaging to be done at depths in which, hitherto, it has been impossible to work for any length of time.

Ordinarily, a diver works in the darkness in from 30 to 60 feet of water. Now Captain Leavitt claims that with his invention divers have reached a depth of 361 feet, remaining for several hours at depths ranging from 194 to 318 feet. Also that the new deep-sea lamp will withstand more than 10 times ordinary air pressure, giving almost daylight illumination.

The lamp is of the vacuum incandescent type, with a heavy glass bulb fitted into a bronze cap. The electric wires are inclosed in a cable. A group of three lights is provided for each diver, the heavy bronze caps acting as weights.

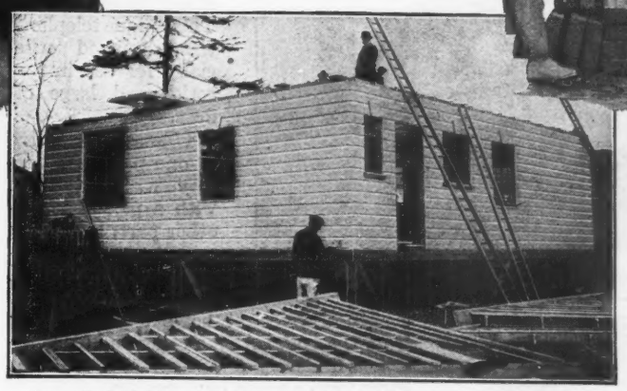
The diving suit is made of manganese bronze and has ball-bearing joints. The flexible sections are of interlocked copper tubing wrapped and lined with rubber. On the back of the suit is an air chamber that supplies the diver with air for four hours. He sees through glass windows and has a telephone with which to communicate with the ship above.

New Steel Homes Go Up Like Magic



In one method of construction the framework is built of timber in sections. To these timbers then are attached an outer wall of metal

Where steel framework is used, the exterior is formed of concrete blocks, locked in place



A small steel home nearing completion. The exterior, on a wooden framework, is formed of steel sheets embossed to imitate stone blocks

URGENT need of houses that can be rented at prices a workman can afford to pay, has brought about a new type of steel home in Great Britain, principally in Scotland. They can be erected, largely by unskilled labor, almost overnight.

Three motor-trucks are said to be sufficient to carry the materials for a complete house from the factory to the site. No excavation is necessary and the parts are easily put together. Some of the buildings with six rooms are now being erected for about $2200 each, approximately half the cost of a house of similar size made of brick and plaster.

The steel, in plate or sheet form, is used in some cases for the exterior of houses; in other cases for interiors or lining. In one type, a wooden framework is constructed in sections. To this are fixed metal sheets that will form the outer walls of the house.

Inside the framework, interior walls of various kinds of composition are placed, leaving an air space between the outer and inner walls.

Other builders are using steel framework instead of timbers. The parts of this are marked plainly and fit together readily, it is said, enabling four men to erect the framework of a house a day.

The outer walls of this type of house are made of slabs of synthetic stone that lock into place, hiding the steel framework completely. In the interior, the steel is covered with a lining of composition sheets, giving the appearance of ordinary walls.

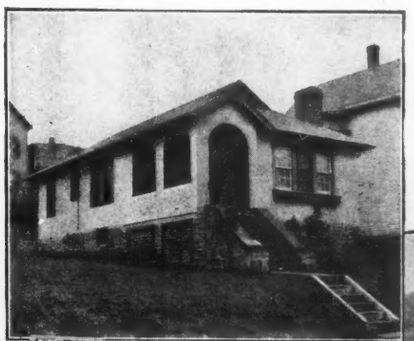
Houses Made Fireproof by Gypsum Concrete Walls

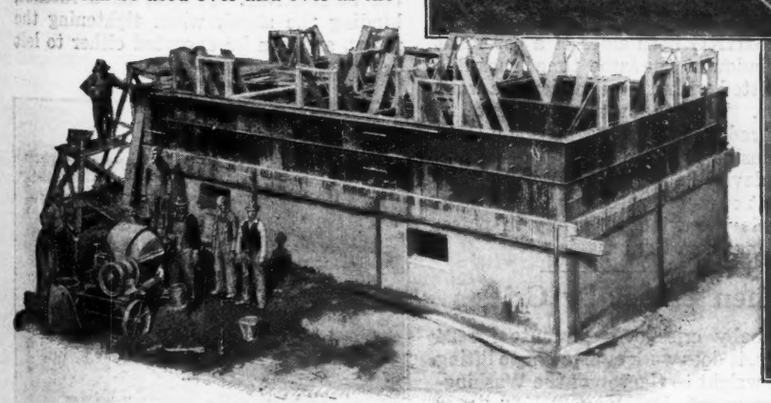
GYPSUM, commonly called "plaster of Paris," which has been used for centuries for plastering walls, is the essential part of a new fireproof building material. Mixed with cinders, gravel, crushed stone or furnace slag, and poured in forms, it can be used to construct main walls and partitions of one- and two-story buildings. It is said now to be possible to erect an entire house of this incombustible material at a cost that compares favorably with that of a wooden building.

While it takes ordinary concrete several days to harden, gypsum concrete is said to harden within 30 minutes. This speeds up construction work, lessening time and labor costs. Also, since the material sets so rapidly, a comparatively small number of forms can be used over and over as the walls go up. Another advantage is that gypsum is considerably lighter than concrete.

All corners and openings are reinforced by steel rods or welded steel fabric. In one-story construction, outside walls are made at least six inches thick; in two-story buildings eight inches, while partitions need be only from three to four inches thick.

In a laboratory test made recently by the Department of Civil Engineering at Columbia University, a wall of gypsum concrete was exposed to fire, and kept under a temperature of 1700 degrees for an hour. After the test the exterior surface of the wall showed no signs of the heat. When the side of the wall exposed to the flames was washed with water, it showed a little of the cement washed away, leaving a slightly pitted surface.

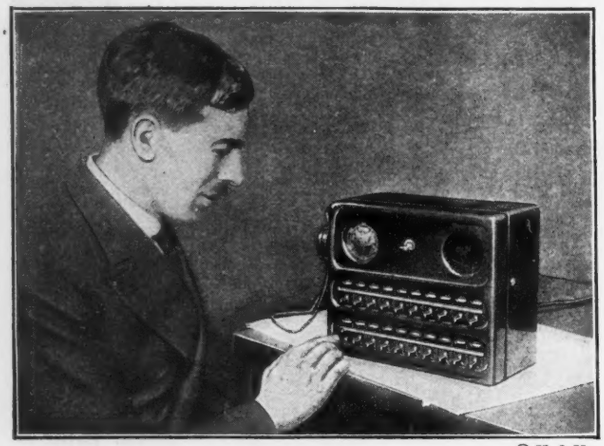




"Pouring" a gypsum-concrete house. From the mixer the concrete is passed up by hand to the wall, where it is poured between the metal forms. Note how window frames are set in the forms. The upper picture shows a completed dwelling of bungalow type

The fire-and-water test. After an hour's exposure to flames at a temperature of 1700, following by 2½ minutes of water at 30 pounds pressure, the gypsum-concrete walls shown above were practically undamaged

Newest Telephone Is Loudspeaker



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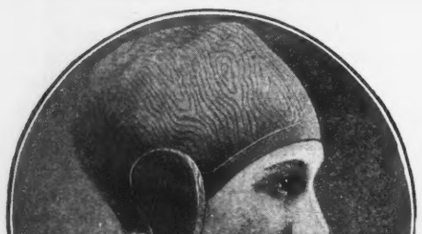
The new telephone apparatus without mouthpiece or receiver

A TELEPHONE without mouthpiece or receiver! Press a button and talk into the air in a natural tone of voice and the message will be repeated at the other end of the wire. This unique telephone was designed especially for use in factories and large offices.

When an executive in one part of a factory wishes to talk with a person in another part, he simply presses one of a number of keys, and speaks his message in a natural voice at some distance away from the box. At the other end his voice is heard clearly and distinctly, as if it came from a radio loudspeaker.



Water-Tight Bathing Cap Gives Ear Comfort

EVERY woman swimmer knows how troublesome her ears can be. A cap, when tight enough to keep water out when swimming Indian fashion or diving, often exerts an uncomfortable pressure.

To relieve this, a new bathing cap has built-in ear pockets. Its chin band, when adjusted, causes an inward pressure on the ribs of the cap, sealing all open spaces and keeping the hair dry.

Crust of Bread Found to Be Less Nourishing

MAKING children eat bread crusts may be a useful practice from an economical standpoint, but the time-honored belief that the crusts possess better dietary qualities than the center of the bread seems to have scant basis in fact. This was revealed in some interesting experiments just completed by Professor Roscoe Hart Shaw of the American Institute of Baking.

Professor Shaw took two young albino rats of the same brood, and fed one on crusts and the other on crumbs from the centers of the same loaves. The rat that was fed on crumbs reached normal size at maturity and was strong and sturdy, while the other remained scarcely larger than a mouse and was weak and puny. Repetition of the experiment on other rats brought always the same result.

Window-Washing Eased by New Mounting

WASHING both sides of a casement window at the same time is possible if it is fitted with a new carrier quadrant adjuster. The window may be opened to any desired position by regulating a lever on the inside of the house.

The device in which the teeth of the quadrant engage a catch on the window-sill, holds the windows firmly in place, preventing them from sagging.

When the Baby Cries

IF A baby cries every minute for 24 hours, it does work equivalent to lifting its own weight to the top of the Washington Monument, Dr. John R. Murlin of Rochester, N. Y., has figured.

Hot Water Always on Tap with Electric Heater

AN ELECTRIC water heater, fitting at the back of a washbowl, is said to produce hot water in a few seconds when the handle of its single faucet is turned to the right. By turning it to the left, cold water can be obtained.

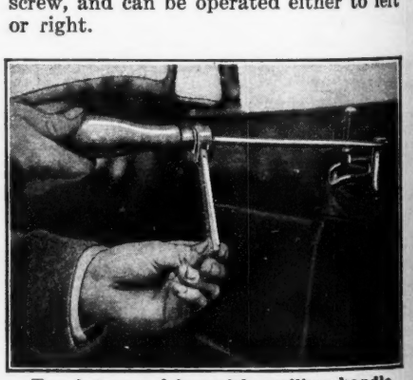
The temperature and flow of the water can be regulated to any desired degree and volume by turning a thumbscrew on the right-hand side of the heater. The heater is attached in place of the ordinary faucet and connected with the electric service circuit.

AN OBSERVATORY for avalanches, believed to be the first of its kind, has been erected in Tamischbachturm, Austria, by the State Railway. Its object is scientific and practical. It has been fitted with recording instruments, and it also will send out warnings when avalanches threaten.

Ratchet Lever Adds Power to the Screwdriver

IN SETTING or removing slotted head screws, the lever of this screwdriver takes the place of a wrench. It operates with a ratchet, making unnecessary the many quarter turns needed when the wrench method is used.

The auxiliary handle of the tool has a cam-shaped bearing against the shank of the screwdriver. It acts as a ratchet, binding the shank when tightening the screw, and can be operated either to left or right.



Turning screwdriver with auxiliary handle

Gummed Labels Moistened by Automatic Device

IF A gummed label is moistened insufficiently it will fall off a package. Too much moisture floods the gum, making the label useless. The new labeler illustrated is said to moisten labels automatically with just the amount of water needed.

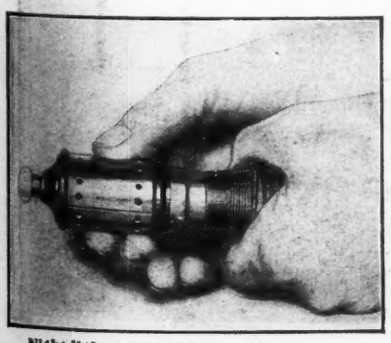
The label is passed under an automatic presser, which holds it against a rubber-set brush. This is kept moist by water contained in a small tank.

Hardest Sounds to Hear

SYLLABLES ending in "ng" are the most difficult for human ears to grasp, while those with "s," "w," and "y" apparently are the easiest. These conclusions have been reached through recent investigations by Dr. V. O. Knudsen. In tests with a large audience in an acoustically poor auditorium, only 48 per cent caught such sounds as "ting" and "bong," while from 90 to 100 per cent were right on sounds like "wis" or "yox." The sounds "d" "b" and "th" made a poor score.

Electric Night Light for the Sickroom

SCREWED into an ordinary lamp socket, this electric night light gives just enough illumination to prevent a child from being nervous, or to dimly light a sickroom. The light may be used for 35 hours at a cost of one cent, it is claimed.



Night light inserted into ordinary socket

Portable Amplifier Aids the Deaf

A NEW sound-amplifying instrument invented recently by Marconi to help deaf persons to hear, employs a microphone and two vacuum tubes so arranged as to receive and magnify speech at a considerable distance. Voices near the microphone are magnified to such an extent, it is said, that even a man whose hearing is very poor can hear the speech distinctly, even with the reproducer placed on the top of his hat instead of against his ear.

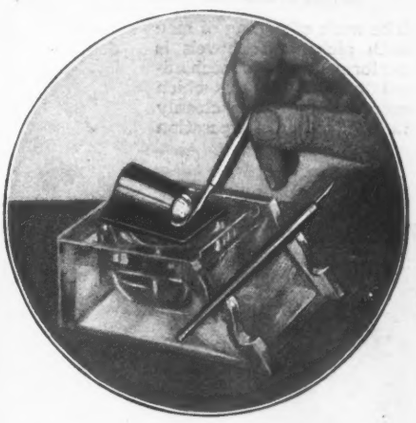
Hearing with the reproducer placed on top of his hat

The instrument is designed on much the same principle as the audio amplifiers used in radio. It is so compact that it can be carried in a small case.

New Curtain Rods Adjusted from the Floor

HANGING curtains, a dreaded job in most households, is made a simpler task with the new type of curtain rods shown above. There is no need of climbing up to the rod on a ladder or chair. Instead, the curtain rod is lowered so that the draperies may be adjusted from the floor. Relieved of the strain of raising her arms above her height, the housewife is able to drape curtains to her complete satisfaction before raising the rods.

The bars on which the shade, curtain, and draperies hang can be adjusted at any height by the operator by pushing the bars up against the window-frame and allowing them to drop in slots in brackets screwed to each side of the window frame. By lowering the draperies halfway and opening the upper sash of the window, ventilation is obtained, with privacy.



Rolling Ball Serves as a Cover for Inkwell

THE annoyance of removing the cover of an inkwell every time a pen is to be used has been obviated by an ingenious cover that is closed by a small glass ball rolling on a runway. When a pen is inserted, the ball is pushed back easily. As the pen is removed, the ball rolls forward, closing the well from dust and air.

The top and runway for the ball are made of metal.

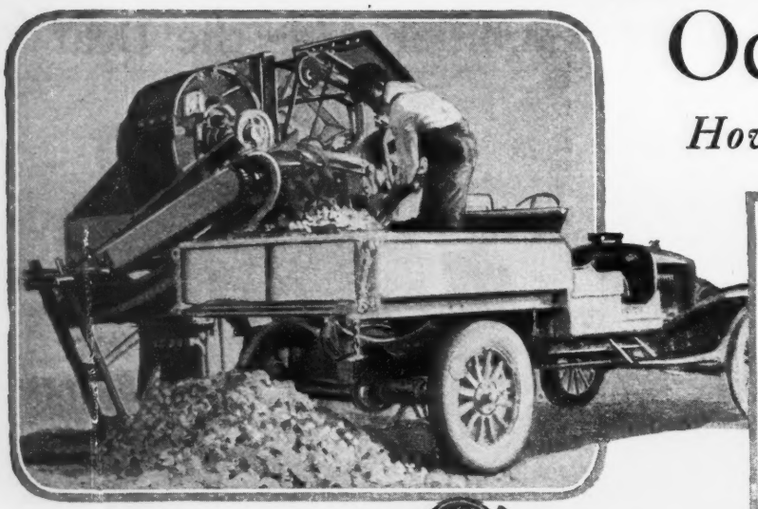
Why a Cat Always Lands on Its Feet

ALMOST everybody probably has tried the experiment of turning a cat upside down and dropping it to the ground to see it right itself in falling and land on its feet.

Recently Professor R. Magnus, of the University of Utrecht, Holland, set out to learn why it is that a cat possesses the odd ability to change the direction of its body while falling. He discovered that it is entirely a mechanical, or reflex action which the cat performs unconsciously just as we close our eyes when some one aims a blow in our direction. This discovery was made as a result of performing the experiment with a cat from which he had removed the ability to perform conscious actions by an operation on the brain. After the operation the cat fell feet down when it was dropped, just as it did before.

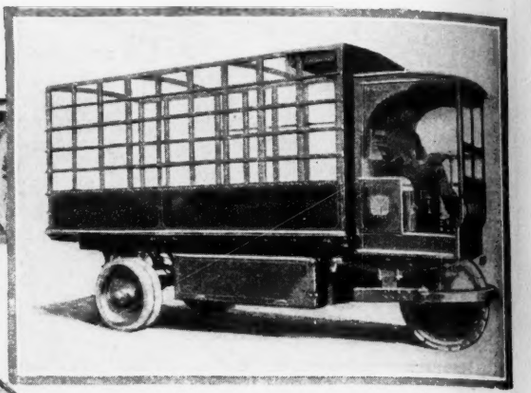
Odd Machines

How Men with Unusual Ideas



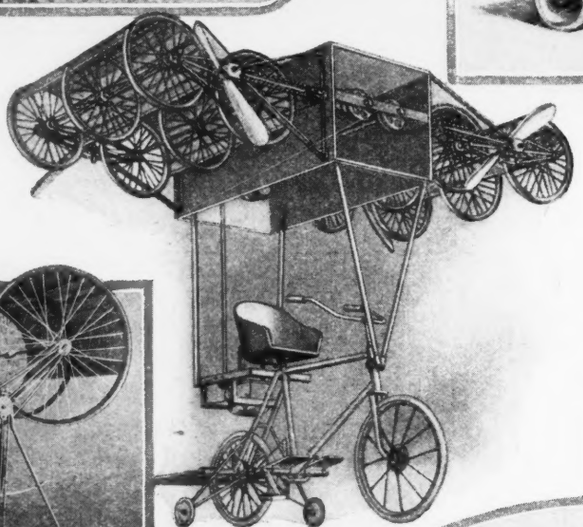
Digs Ditches

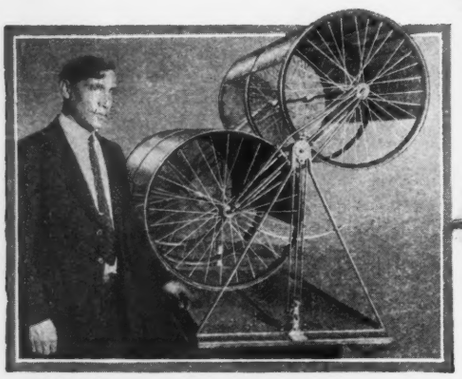
The work of a gang of men with picks and shovels is performed by this mechanical trench digger, which scoops out a ditch cleanly in one powerful operation



Third Wheel for Truck

For use where extremely short turns are required in close quarters, a third wheel that can be handily substituted for the two front wheels of a motor-truck at need, recently has been invented





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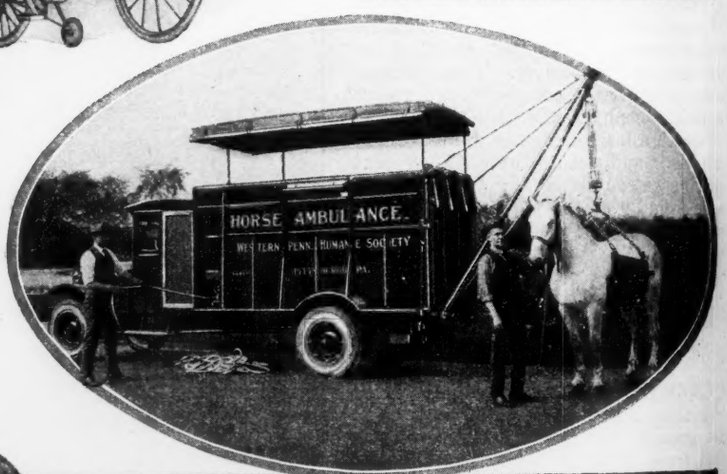
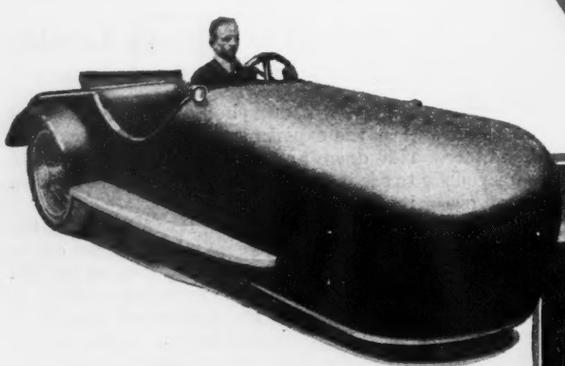
Invents a Flying Bicycle

For 25 years Israel Zipperstein, a Chicago vest-maker, has devoted the greater part of his evenings to the invention of a flying bicycle, with cylindrical revolving wings shown in his working models above

Ambulance for Horses

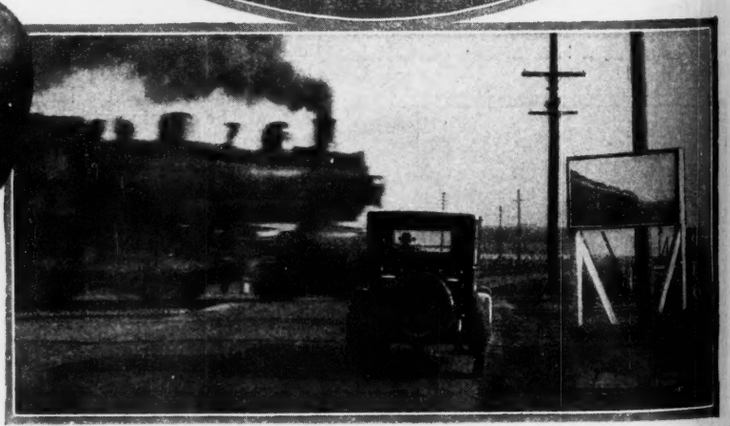
To aid in transporting sick or injured horses, the Western Pennsylvania Humane Society recently placed in operation the novel motor ambulance shown below. A small crane operated by the truck motor lifts the animal into the car





Odd Auto Shaped like a Shoe

This strange roadster, exhibited at a recent German automobile show, is built to resemble a giant shoe

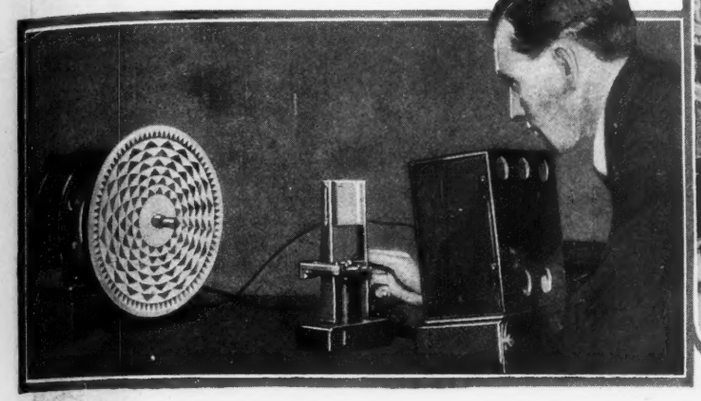


Mirrors for Dangerous Crossings

Large mirrors set up at "blind" railway crossings are among the latest safety devices to safeguard motorists

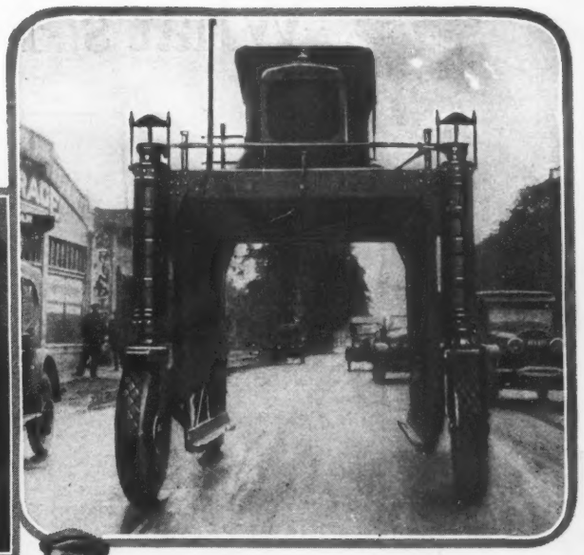
and Inventions

Turn Them to Unusual Uses



Speed Measured by Sight

Accurate measurement of the speed of a rapidly revolving shaft is obtained with this remarkable apparatus consisting of a disk pattern revolving on the shaft and observed through an electrical vibrating instrument. The visible form of the revolving pattern determines the speed of the revolutions

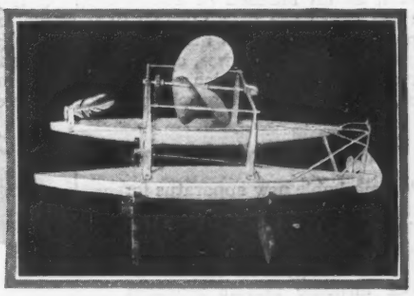


A Long-Legged Tractor

Recent improvements on the "tractor on stilts," invented some time ago for lifting and transporting piles of lumber, have evolved this amazing machine. It can straddle a lumber pile and lift it automatically with its mighty mechanical arms

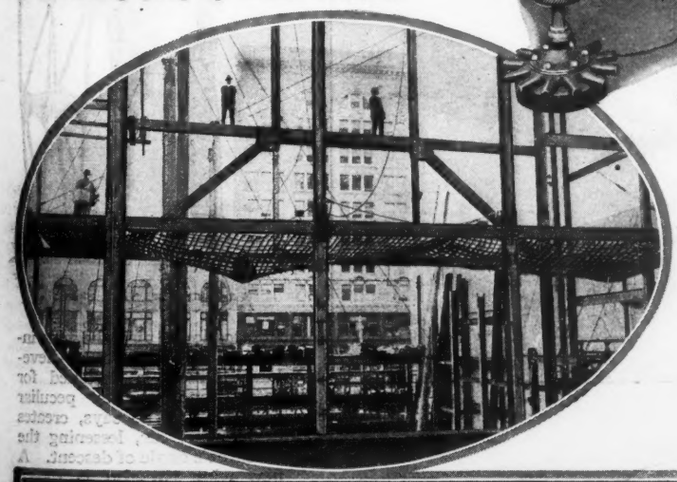
Nets Safeguard Workers

Structural iron workers, though they are marvelously sure footed, sometimes slip and fall. As a safety precaution, nets made of woven rope, resembling circus nets, recently have been strung across the lower girders of a building going up in San Francisco



Wind-Driven Boat

This is a model of a remarkable boat recently designed by a Berlin inventor. A windmill above the water drives an under-water propeller by means of chain gear



Auto Lamp

Instead of driving his old car to the junkman, Forrest Gibbons of Dayton, Ohio, fitted some of the parts to form this floor lamp

Mechanical Pacer Aids Runners

To help track athletes maintain the correct stride, Coach Thomas E. Jones has invented this pacing machine that rings a bell at definite intervals

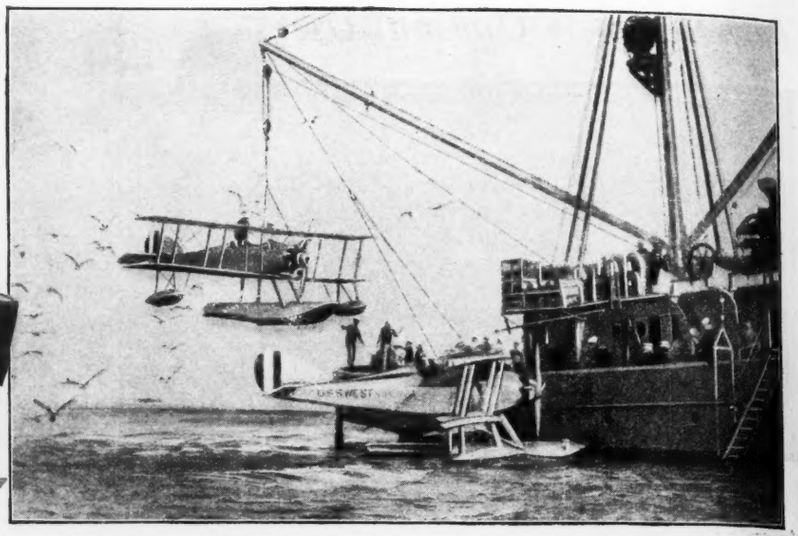
Builds Model of Brooklyn Bridge

A remarkable model of the famous Brooklyn Bridge (left) is the work of Michael Newman of Boston, Mass. It is 16½ feet long, two feet wide, 4½ feet high, and is lighted by electricity

What's New in Aeronautics

Speeds Up Map-Making

With this remarkable mapping camera designed by an army officer, it is possible to map approximately 2000 square miles with one loading of film, at an altitude of 15,000 feet. This is three times the area possible in a single exposure with previous mapping cameras. The camera has three lenses, one in the center and two at an angle, which operate at the same moment, thus photographing three pictures

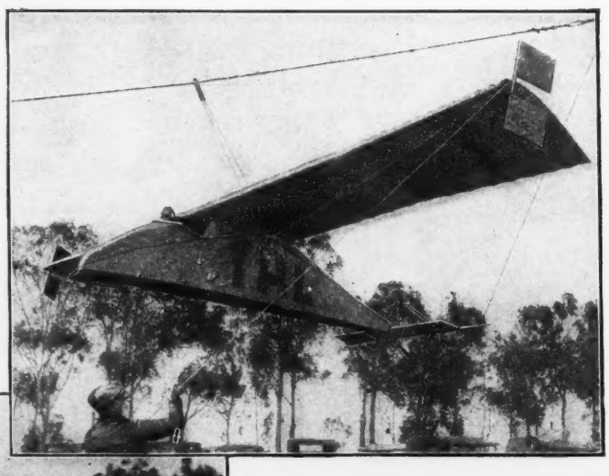


Planes Repaired at Sea

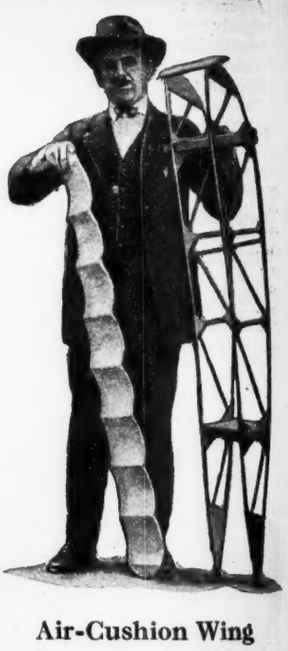
Airplanes now may be repaired and refueled in midocean, the navy having established the repair ship shown above. It is designed to operate with the battle fleet to take care of small planes operated by catapult from various dreadnaughts, but it can handle larger planes in an emergency. The photograph shows how a plane is lifted from the water by the repair ship

Gliders Tested Safely

A remarkable new apparatus for testing gliders under safe conditions is an outdoor wind tunnel built by the California Institute of Technology. It consists of four airplane motors mounted behind a grill-like structure that breaks up the current of air into an even flow. In front of this the glider is suspended on a cable by a pulley, and the effect of actual gliding is produced without danger. At the right is seen a glider mounted in front of the Institute's wind tunnel



Four airplane motors force air through the grill-like device, forming a wind tunnel on the other side, in which gliders are suspended, making it possible to conduct experiments with safety and accuracy



Air-Cushion Wing

An escalloped airplane wing invented by Julius Fox of Cleveland, Ohio, is designed for safer landing. Its peculiar construction, he says, creates cushions of air, lessening the machine's angle of descent. A new wing rib also is shown

Baby Biplane Is Easily Dismantled

This sturdy little machine is claimed to be the world's smallest practical biplane. It is 16 feet long, six feet high, and has a wing spread of only 20 feet. By removing seven bolts, it is said that the plane can be dismantled in less than half an hour

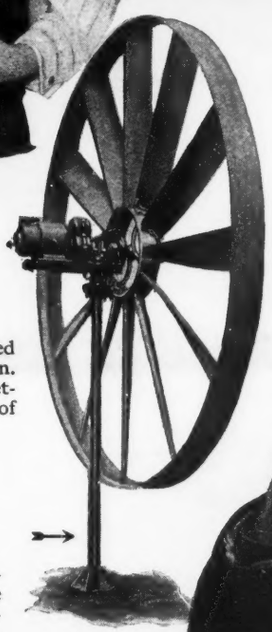
Novel Ideas Made Practical

Burglar-Proof Vest

To prevent robberies from bank messengers a steel vest has been invented to hold bundles of money or securities. Locked and concealed on the waist of a messenger, it cannot be opened until he reaches his destination. The vest is claimed to be bullet-proof as well as burglar-proof

New Life-Preserver

A combination of inflated tire, rubber trousers, slippers, and leg paddles makes up this ingenious life-preserver, in which, it is claimed, one can sit comfortably in the water until rescued. With paddles operated by the hands, as shown above, the life-preserver acts as a boat

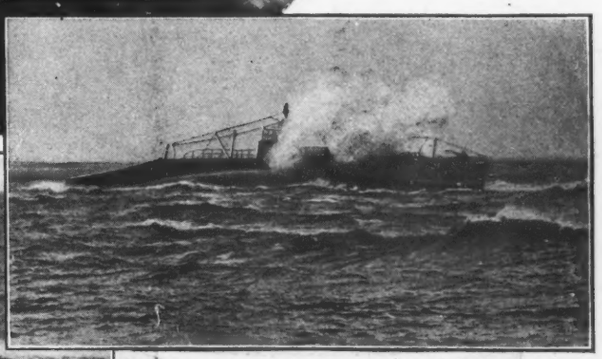


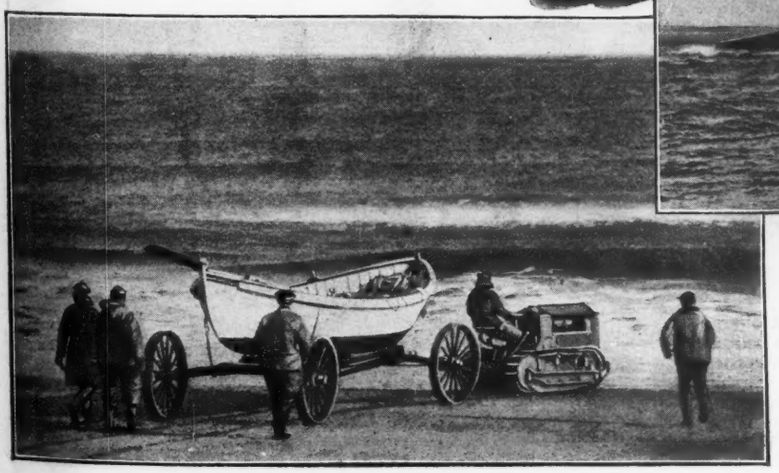
Power from Wind

A new windmill designed recently in England to produce greater power is based on experiments on aerofoils and air-screws. The metal blades of the windmill are curved like a bird's wing. A hoop encircles the tips of the blades, confining the air and preventing what are known as "end losses," a common failing with the ordinary windmill

Takes Movie Snapshots

Weighing only 4½ pounds this automatic motion-picture camera can be carried easily on picnic outings, to record the day's adventures. It has a universal focus lens that eliminates the necessity of adjusting the camera for distance. In using the camera it is lifted to the eye and a button pressed. This turns an invisible crank either for motion-pictures or for "stills"



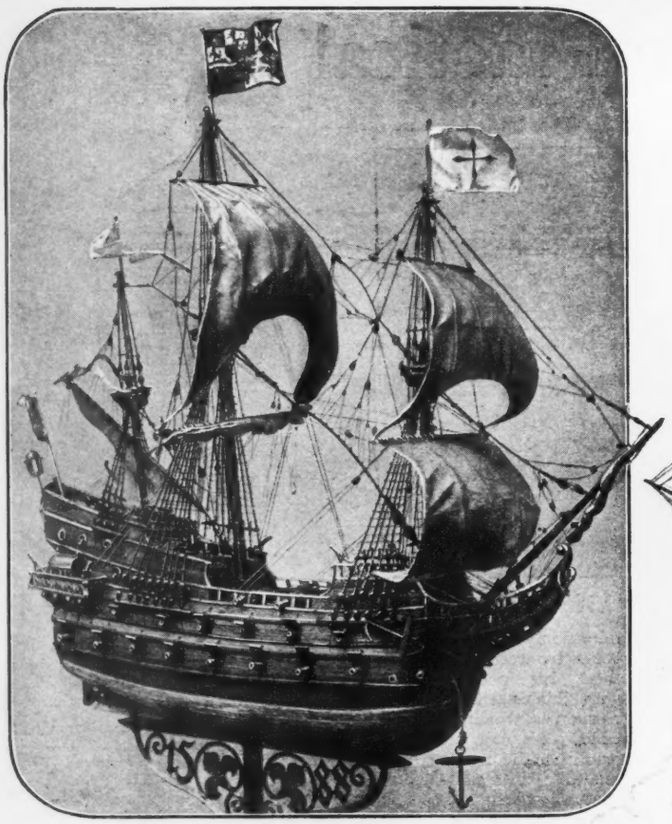


Tractor Aids in Thrilling Rescue

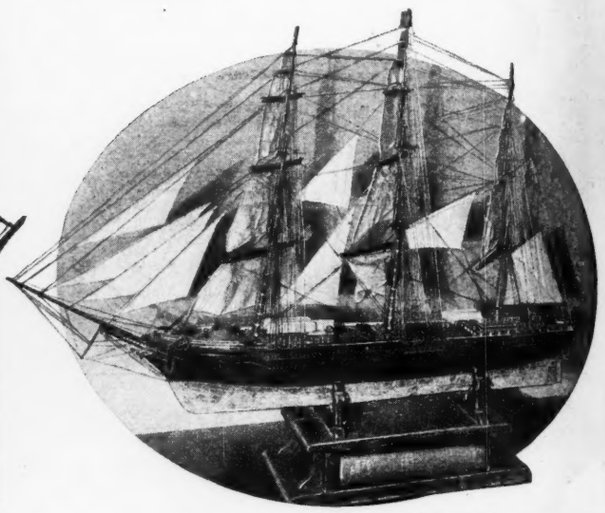
When the U. S. Submarine S-19 grounded recently at Nauset Beach, Cape Cod, the Coast-Guard Station there made effective use of a small tractor in launching the lifeboats in heavy seas. The above photograph shows the grounded submarine receiving a watery broadside. At the left the tractor is seen pulling a lifeboat, preparatory to launching it. In the rescuers' first attempt to reach the submarine, their surfboat capsized. A second attempt was successful

World-Famous Ships in Miniature

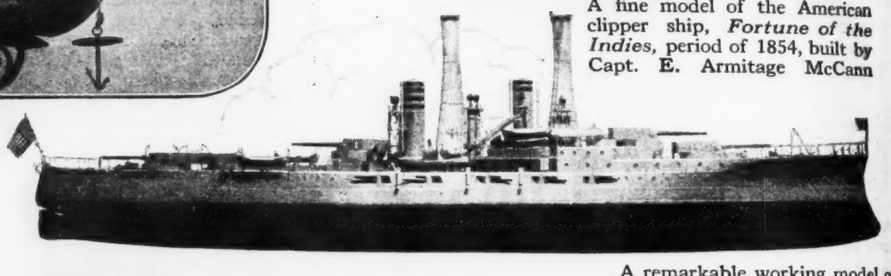
Model-Makers Show Amazing Skill



This highly ornate model of a picturesque Spanish galleon of 1588 was made by Frederick Stern

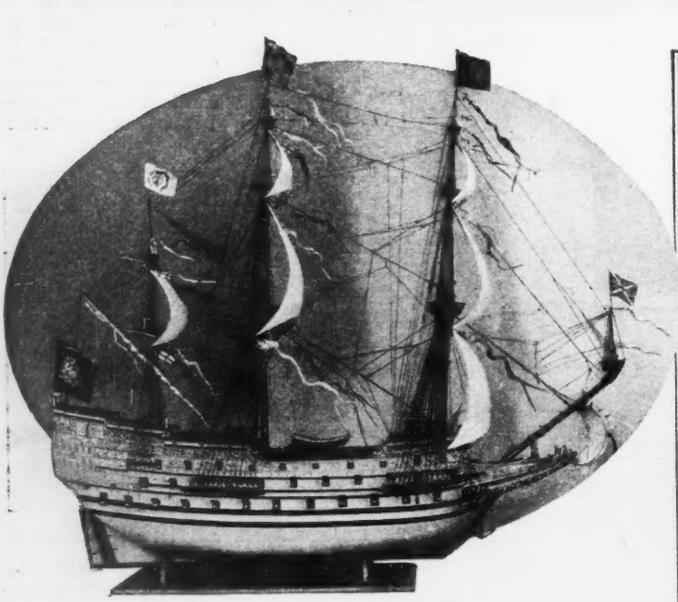


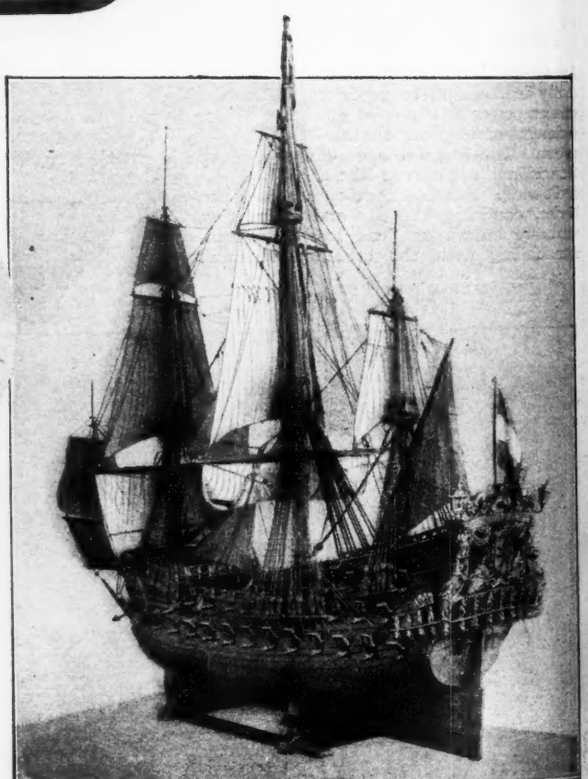
A fine model of the American clipper ship, *Fortune of the Indies*, period of 1854, built by Capt. E. Armitage McCann



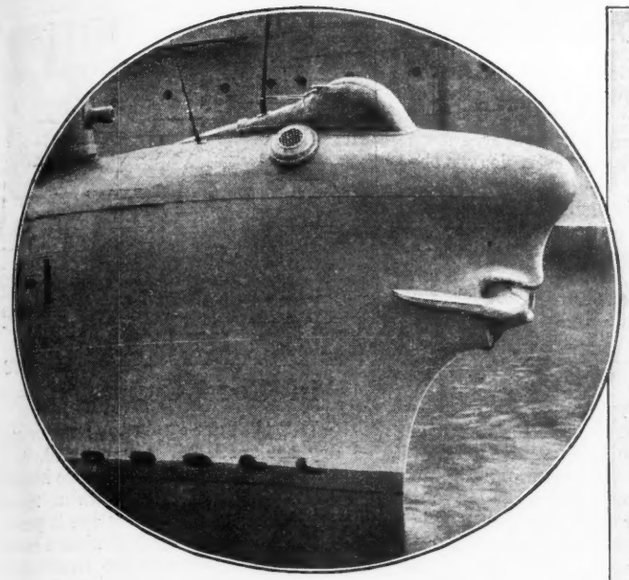
A remarkable working model of the *U. S. S. Dakota*. Controlled by radio, it can be maneuvered from a shore station. It is the work of Charles A. Myers, Jr.

The design of the *Monitor* of Civil War fame is preserved in a contemporaneous box model (below) showing the interior arrangement





All the elaborate carving, gilt and paint that characterized the fighting ships of the seventeenth century have been copied in the most painstaking detail in these two models. Above is the British first-rate warship, *Sovereign of the Seas*, built by Henry B. Culver and sold for $30,000. At the right is a copy of the Dutch 50-gun ship *Hollandia* of 1660, made by E. W. Ottie



Our Newest and Biggest Submarine

TWICE as large as the biggest undersea vessel ever before built in the United States, the submarine cruiser V-1, launched at the Portsmouth Navy Yard last summer, was commissioned a few weeks ago and now is in service with Uncle Sam's Navy.

First of three submarine cruisers to be built for the navy, the V-1 is designed primarily to accompany the fleet at sea in any weather and to maintain any speed of which the fleet itself is capable. She is 341 feet long, 27 feet maximum breadth, with 2164 tons displacement. Her surface speed is 21 knots, and her submerged speed nine knots.

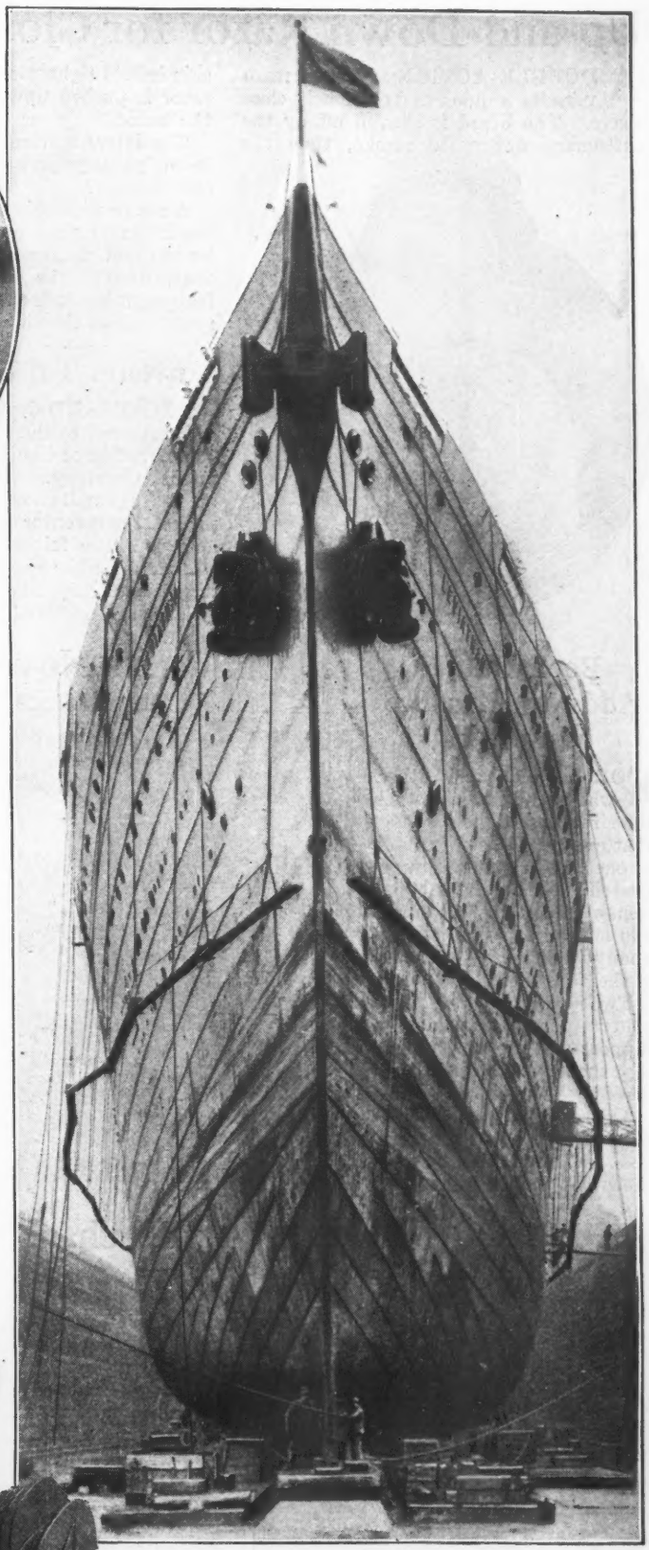
The vessel is propelled by four Diesel engines developing 6500 horsepower. Her armament consists of six 21-inch torpedo tubes, one five-inch, 51-caliber rifle, and two machine-guns.

All that Remains of Junked Warships

OF THE thousands of tons of material in the United States battleships junked recently, under the Armament Treaty, only the triple line of anchors below remains to serve as a reminder. Filed away in the Boston Navy Yard they are attracting much attention from visitors.

Each anchor has a number, and its height, weight, and type are kept on file in the office of the Navy Yard. The name of the vessel to which the anchor belonged also is listed carefully. The small anchor in the center of the photograph weighs 1000 pounds. From this the weight of the giant anchors surrounding it can be judged.

Marked with number, height, and weight, the anchors form a unique filing system



The Great Leviathan in Drydock

SOME idea of the immense proportions of the steamship *Leviathan* is given by this unusual photograph showing the huge vessel in drydock at South Boston, Mass. This was the only drydock in the United States that could hold her. Compare her size with that of the workmen at the bottom of the picture.

When completed in 1914 the vessel was the largest in the world. Since then she has been surpassed in size only by the White Star Liner *Majestic*. Originally designed to carry about 8400 passengers, Uncle Sam found room aboard her for more than 12,000 of his fighting men.

Up-and-Down Razor for Close Shaves

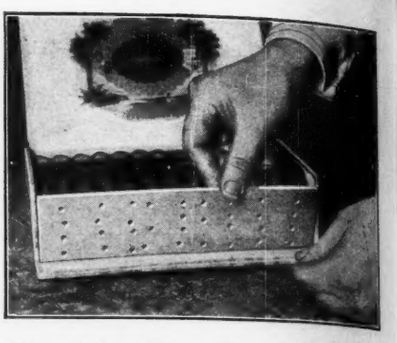
A DOUBLE-ACTION safety razor permits a quick and extremely close shave. The beard is shaved off by the customary downward stroke, then the skin is held tight with one hand while the razor is pushed upward against grain of the beard.

The latter motion of the razor, shown in the photograph at the left, leaves the skin smooth.

A shave with this device is said to last much longer than ordinarily, because of its unusual closeness. It is also claimed that, due to the razor's double-action feature, it is much easier to shave certain spots such as the chin and the jawbone.

Invents Talking Postcard

A POSTCARD device that tells its message not to the eye but to the ear is the invention of Charles Rammelsberg, of Berlin, Germany. With a phonographic apparatus small enough to be carried in a pocket, the inventor states that any one is able to make faithful voice records on gelatine films the size of postcards. Each record has a capacity of from 600 to 800 syllables.



Humidor Box Keeps Cigars in Good Condition

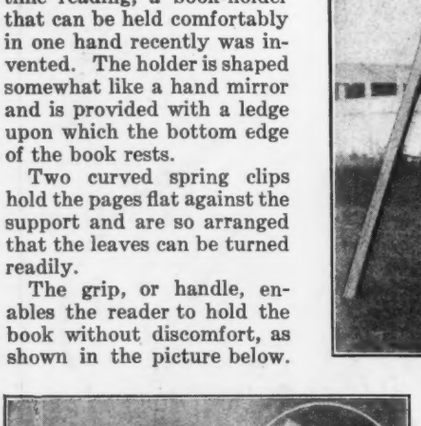
CIGARS that are either too fresh or too dry are restored, it is claimed, in a new type of box provided with two hinged front sections between which a moist blotter is inserted. One section is perforated to permit the cigars to absorb moisture. If the cigars are too fresh, both sections are opened, exposing them to the air.

Book-Holder Adds to Pleasure of Reading

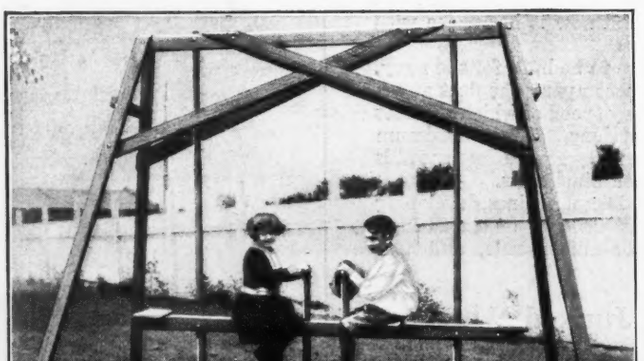
FOR invalids and others who spend much of their time reading, a book-holder that can be held comfortably in one hand recently was invented. The holder is shaped somewhat like a hand mirror and is provided with a ledge upon which the bottom edge of the book rests.

Two curved spring clips hold the pages flat against the support and are so arranged that the leaves can be turned readily.

The grip, or handle, enables the reader to hold the book without discomfort, as shown in the picture below.



Children's Novel Swing Is Rowed like a Boat



SAFER than a rowboat and giving the same exercise for arm and shoulder muscles, is a rowing swing, a new piece of playground apparatus. The swing moves when the levers are pulled back and pushed forward. Added momentum is gained at the same time by pushing with the feet against a swinging platform close to the ground.

The rowers may invite two passengers to sit at the ends of the swing, and even more may be accommodated if they are small and do not weigh too many pounds, for, although supported by strong beams, the swing is built for children.

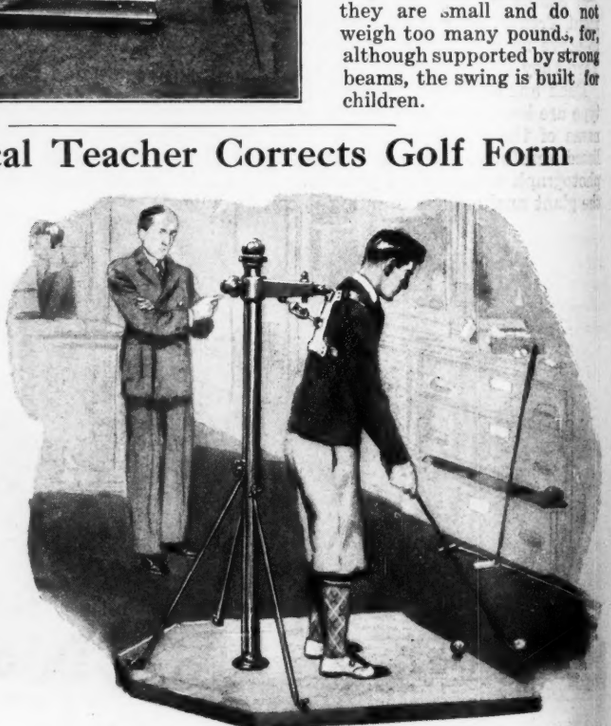
An Automatic Nursemaid Holds Baby's Bottle

AMONG the new ideas submitted to the new bureau established by the French government to foster inventions is a "mechanical maternal arm"—a metal jointed apparatus designed to hold the baby's bottle at the correct angle, and so save the time of the mother.

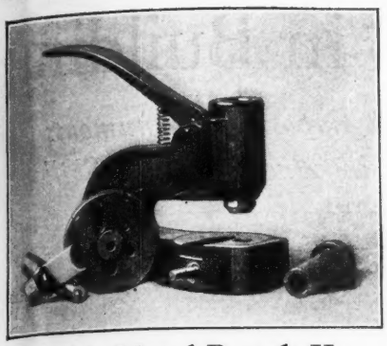
Mechanical Teacher Corrects Golf Form

TO TEACH golf beginners correct driving form, and to correct faults in old players, two Indiana inventors have devised this curious apparatus. A player strapped in the pivoted form is prevented from straightening up, and universal joints in the device are said to teach the perfect swing.

The apparatus is said to correct two of the worst faults that new players must overcome—that of drawing back from the ball or reaching for it in driving.



Strapped to the form, the golfer is held in the position that will give him perfect form in swinging and driving



Portable Metal Punch Has Adjustable Dies

WITHOUT separate dies, this portable punch makes five sizes of holes, from one-eighth to three-eighths inch, in sheet metal up to one-eighth inch thick.

A magazine die is revolved until the size of hole wanted registers. A thumbscrew then is tightened, holding the die in place. Inserting the right sized punch, the hole is punched with a hammer.

New Thawing Torch Burns Kerosene

TO MELT ice and snow on construction jobs, a portable thawing torch, which burns kerosene, is claimed to be a time- and labor-saver. Other uses for the torch are thawing out frozen sand or coal, taking frost out of ground preparatory to excavating or laying conduits, and drying sand.

Danger of setting fire to wooden forms is avoided by directing the flame in such a manner that only hot air comes in contact with the wood.

Automatic Door-Closer

HEAVY metal doors and gates can be opened and closed noiselessly and automatically by a newly invented device operated by a small electric motor. It is designed especially for use in banks for opening and closing the gates of safe-deposit vaults, and for large residences where the gates to the grounds are ponderous and heavy. The motor stops the door at the proper point.

Emergency Threader for Fire-Hose Couplings

DURING the great Baltimore fire, the fire-fighting equipment from Washington and Philadelphia proved useless, because the threads in the hose couplings were different. This has happened quite often when the fire department of one city answers an emergency call from another, for hose bought from different manufacturers varies in dimensions.

In order to remedy this, the Bureau of Standards recently has perfected the set of tools shown in the photograph to cut threads in couplings on the spot.

Fire departments in many large cities now are being equipped with sets of these.

New Stabilizer for Planes

THE problem of automatic stability for airplanes without the use of gyroscopes or other complicated mechanisms is reported to have been solved by a French engineer. His invention is said to consist of an automatic adjustment of the plane's rudders by a weak current from a small battery, and of compressed air from a small aerodynamic compressor.

The appliance already has been adopted on a number of heavy bombers and is reported to have proved a great aid in controlling machines.

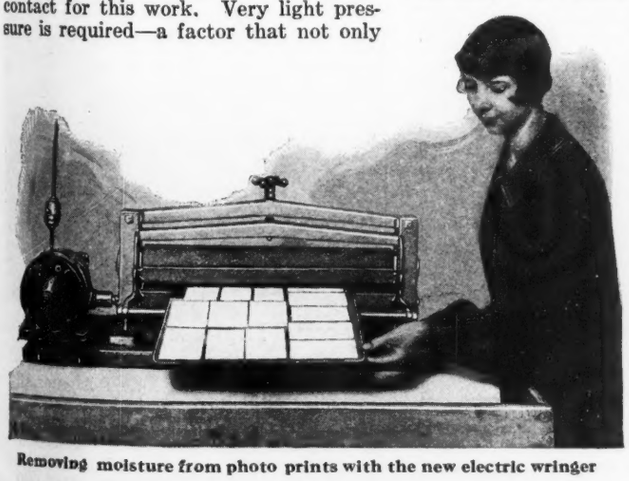
Electric Wringer Aids in Photo Printing

A NEW wringer operated by electricity is made specially for photographic purposes to remove the water from wet prints. Its rubber rollers have a density said to be just right to give the correct contact for this work. Very light pressure is required—a factor that not only prevents the prints from being spoiled, but minimizes the amount of driving power required.

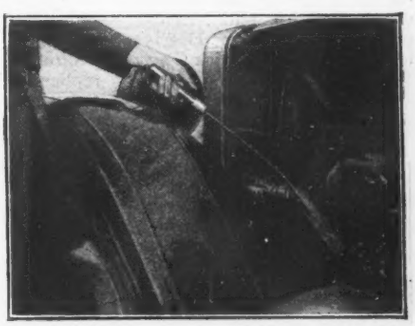
A single central press screw automatically sets a uniform pressure the full length of the rollers.

It is claimed that the wringer will not buckle prints, that it insures uniform drying, preventing the creases often caused by uneven drying, and that it greatly shortens the time required for drying.

The machine is driven by a one-eighth-horsepower motor and can be plugged in an ordinary lighting circuit.



Removing moisture from photo prints with the new electric wringer



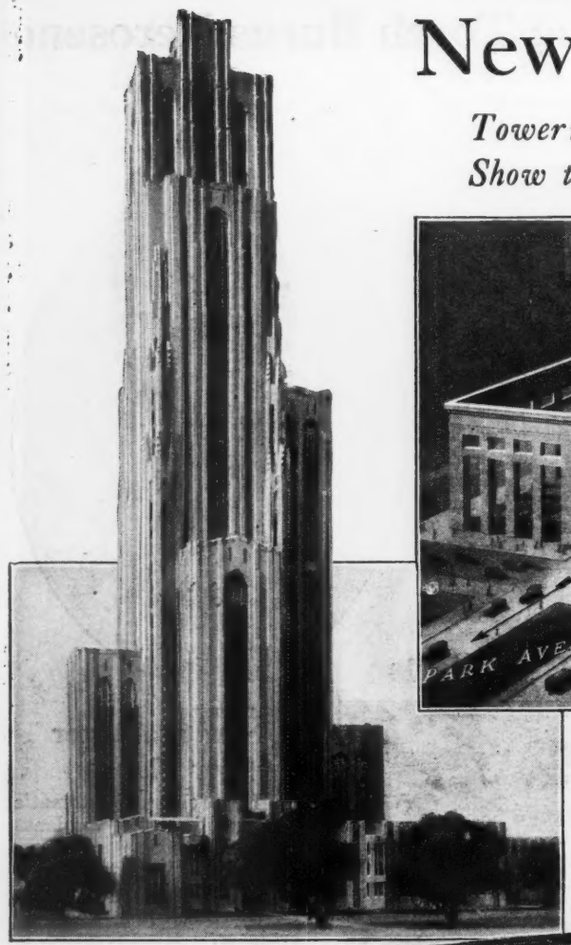
Magnetic Finger Saves Trouble

A LONG rod with a magnetizing device on the end, controlled by a thumb switch on the handle, is a useful tool for picking nuts, screws or other bits of metal out of parts of machinery where they have accidentally fallen.

The rod is attached to an automobile battery terminal and can be bent to any shape. It can pick up two pounds at a time, and works in grease, oil, or water.

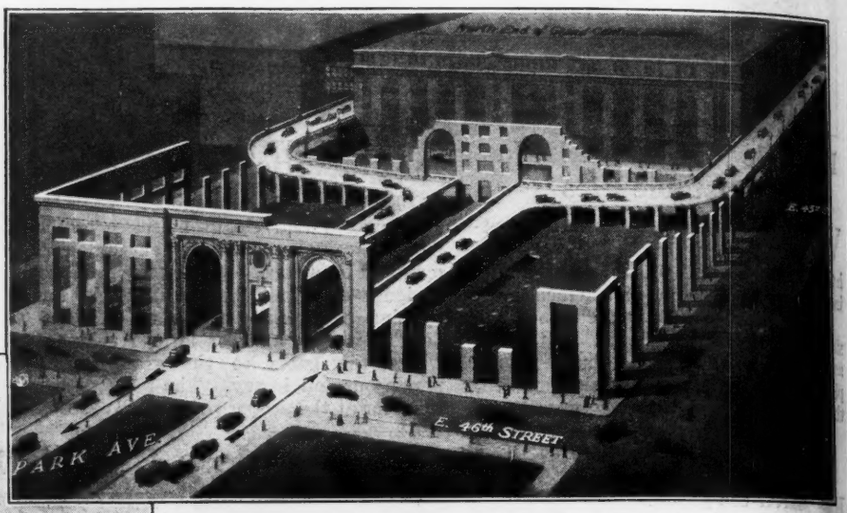
New Marvels in Building

Towering Skyscrapers and Imposing Monuments Show the Latest Progress in Architectural Skill



Skyscraper School

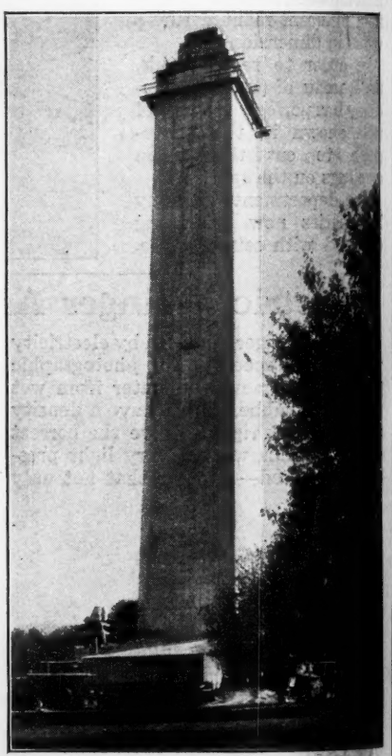
The University of Pittsburgh recently completed plans for one of the world's largest and most beautiful skyscrapers—a 52-story "cathedral of learning" to house the university activities. This structure will cost about $10,000,000, and will accommodate 12,000 students. It will be 680 feet tall, a height exceeded only by the Woolworth Building and Metropolitan Life Insurance Building tower in New York City



Twenty-Story Building to Straddle Viaduct

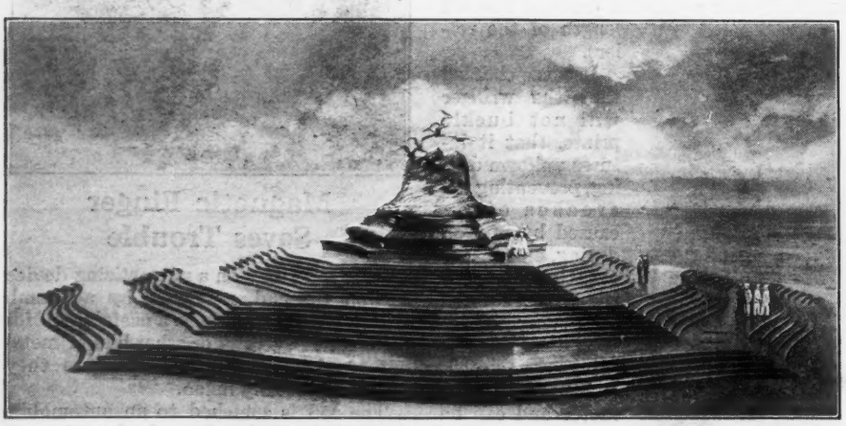
Erection of a 20-story building on the block just north of Grand Central Terminal in New York City hinges on plans by which the structure would be made to straddle a double viaduct roadway in return for closing Park Avenue from 45th to 46th streets. This roadway, running beneath arches through the center of the new building, would lead into broad viaducts around both sides of the Grand Central Terminal

Modern Parthenon—The world's only permanent replica of the famous Parthenon of Greece is under construction in Nashville, Tenn. The structure probably will be a fine arts building and will cost about $400,000



Second Highest Monument

The second highest monument in the world is the Jefferson Davis Memorial, completed recently at Fairview, Ky. It rises 351 feet, and is overtopped only by the Washington Monument, which it resembles. With the park in which it stands, it cost its builders $150,000



On the banks of the Potomac at Washington, will be erected this impressive $500,000 memorial to the American Navy, Merchant Marine, and Coast Guard. The gulls hovering above the central rock without apparent support are an ingenious piece of work by the well known designers, Begni Piatto and Harvey Wiley Corbett

5000 Loaves an Hour

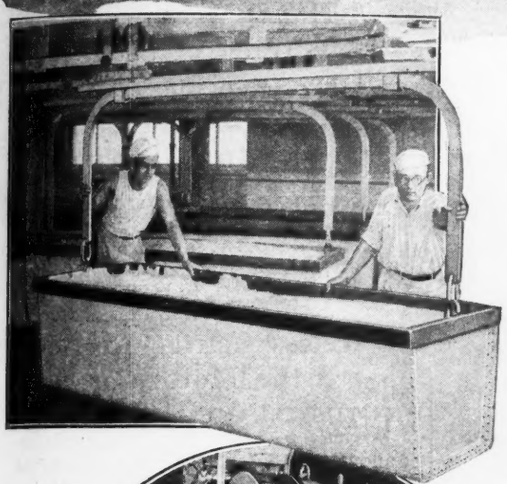
Why Science Bakes Better Bread

MODERN science has caused us to discard many of our cherished illusions. A few years ago, for example, the American housewife would have scorned to serve "baker's bread," because she believed the homemade kind much more nourishing. Now, though, of about 50,000,000 loaves consumed in this country every day, much less than half is homemade. Chemistry, engineering, and other sciences have eliminated the guesswork from the baking industry, and commercial bakeries now offer bread of such uniformly high quality that even the old-fashioned housewife has been converted to its use.

On this page we take you through a modern bakery, letting you see for yourself some of the wonderful things that science has done to make the bread you eat "the staff of life" in fact.

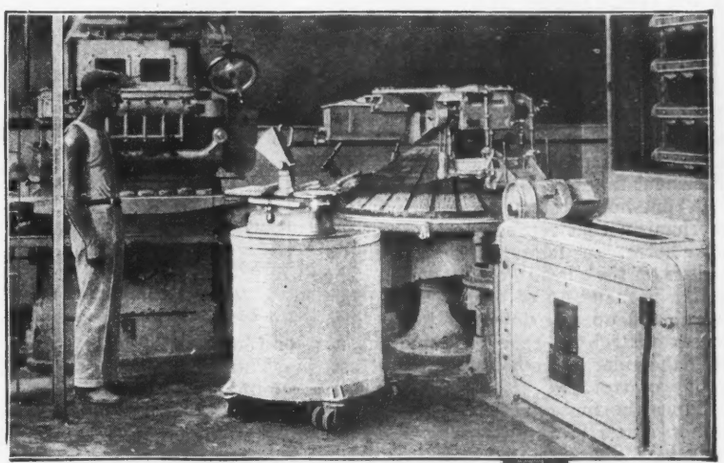
Testing Bread

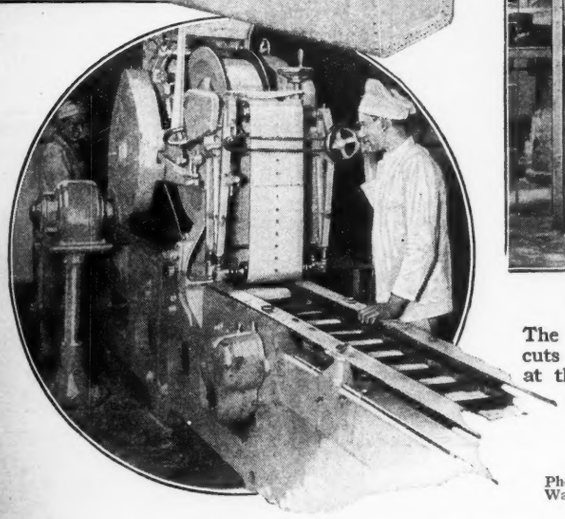
In the laboratory of the modern bakery chemists constantly are testing the quality of the bread



Trough of Dough

When mixed, the dough is discharged automatically into a trough for rising. This process is conducted in a room where temperature and humidity are controlled



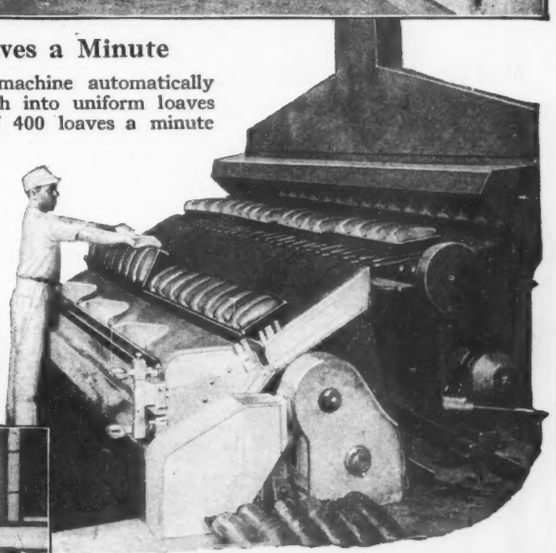


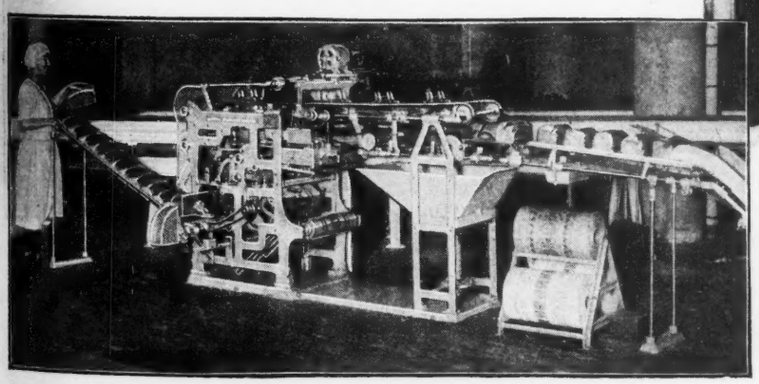
400 Loaves a Minute

The dividing machine automatically cuts the dough into uniform loaves at the rate of 400 loaves a minute

Photos © Ward Baking Co.

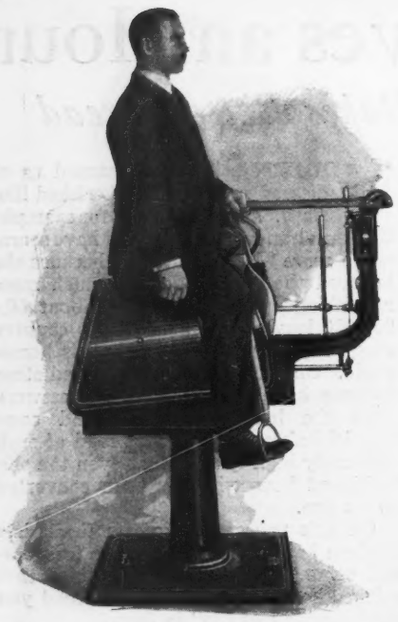
The divided dough is shaped in the molding machine, then placed automatically into an endless series of pans that are placed on a traveling rack that carries it to the steamproofer preparatory to being baked in the huge traveling ovens





Traveling Oven—When the dough in the pans has risen, it is discharged into the traveling bake-oven shown above in rows of sixteen. Here more than 5000 loaves can be baked in an hour

Ready to Eat—After the bread is baked for 35 minutes, it goes into the cooling room, whence it passes on a traveling belt through a machine that wraps it up and seals it in waxed paper



Electric Horse Made Famous by the President

FEW affairs of state have caused more discussion than the recent news that President Coolidge owned an electric exercising horse. In the photograph is shown the kind of "animal" on which the President takes his daily ride.

A one-horsepower motor drives the mechanism that reproduces the motions of a horse. It is started by turning a switch on the "head" of the horse. The action is made up of backward and forward, and up and down motions. Two levers control the speed and motion, so that the rider can go either slow or fast, gallop or trot.

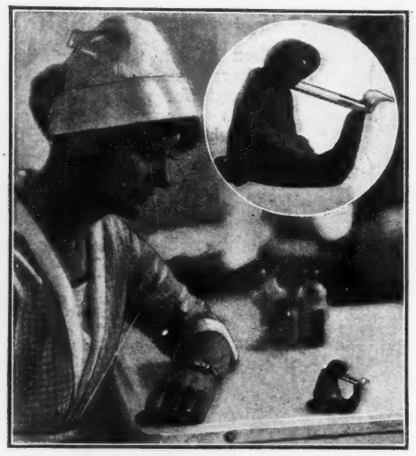
Thus the muscular exercise obtained in horseback riding is duplicated mechanically indoors.

Curious Device Measures Air Circulation

PERHAPS the oddest instrument ever devised to measure the condition of the atmosphere indoors is the little "animal" pictured below. Placed on a table or desk, it not only registers the temperature and humidity, but it tells the amount of air circulation by the beat of red liquid through the glass tube suspended between the mouth and the tail. The rate at which the liquid moves back and forth in the tube is counted.

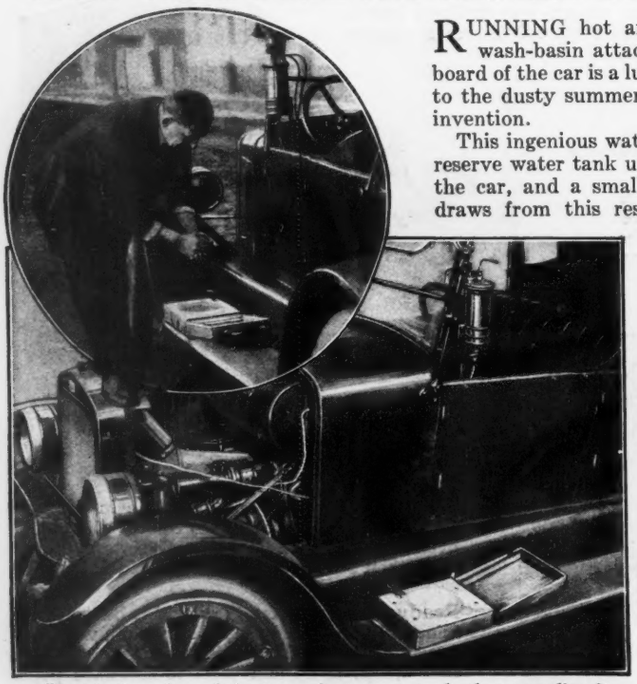
The only motive power is the evaporation of water contained within the device. The more the evaporation, the faster it moves. Reference to a table tells whether the air motion in a room is too great or too little for any given temperature.

Thus, if the temperature of a room in summer is 76 degrees and the device is making only 15 strokes a minute, instead of a minimum of 24, it signifies that more air circulation should be obtained.



Observing motion of the air-tester

Auto Wash-Basin Has Hot and Cold Water



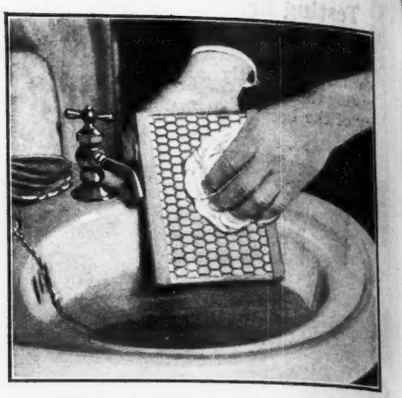
Runningboard wash-basin and vacuum tank that supplies it

RUNNING hot and cold water in a wash-basin attached to the runningboard of the car is a luxury made available to the dusty summer tourist by a recent invention.

This ingenious water system includes a reserve water tank under the rear seat of the car, and a small vacuum tank that draws from this reserve and feeds the water by gravity into the wash-basin.

Two pipes run from the vacuum tank to the basin. One is for the cold-water faucet. The other carries water into the engine-cooling system, where it is heated before passing to the hot-water faucet.

The overflow and vapor from the cooling system pass to the reserve tank.



A Handy Washboard for Traveler or Student

SLIPPED into a suitcase, a small washboard recently put on the market comes in handy for a traveler. The hand slips through a canvas strap at the back of the board. Its size makes it convenient in washing small articles in wash-basins.

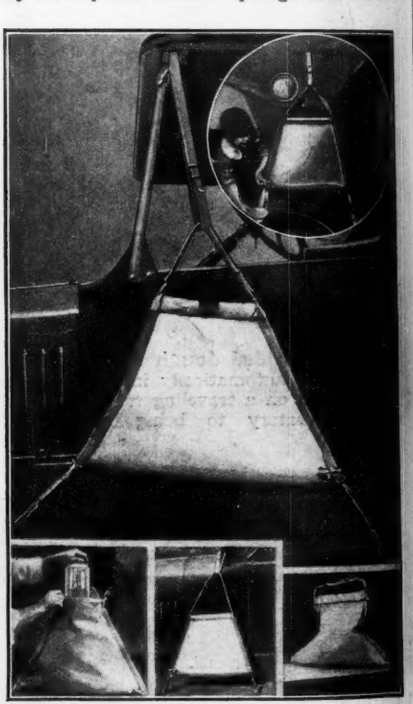
Many a student saves laundry bills by the washbowl method, and this little device comes, also, to his assistance.

Iceless Refrigerator for the Motor-Car

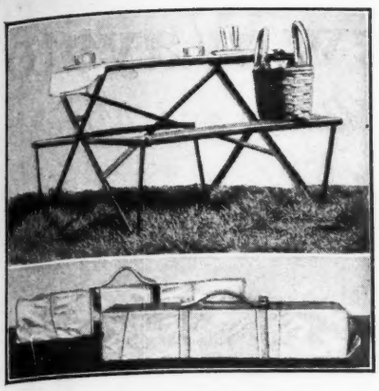
UTILIZING the cooling process of evaporation, a sanitary water-carrier and iceless refrigerator that can be carried on the side of an automobile recently has been designed for use by motor-campers.

It consists of a special container inclosed in a linen bag suspended between the top of the car and the runningboard by a strap and tension springs with claws that hook over the edges of the runningboard.

The cooler will hold five gallons of water, and is fitted with a faucet. (Note the insert above.)



The water-carrier and its uses



New Folding Table Adds to Camping Comforts

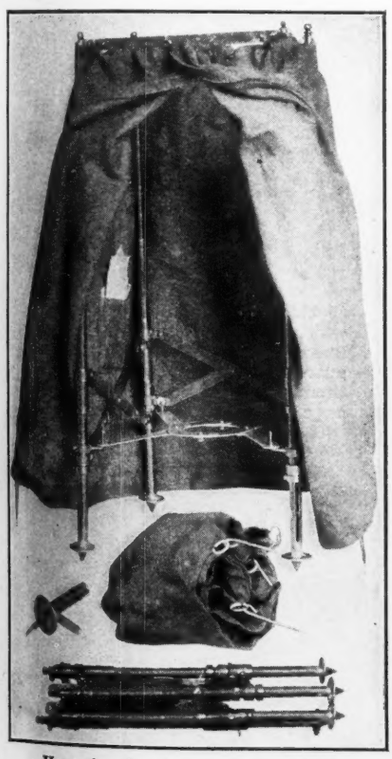
OUTDOOR dining comforts for auto-campers are provided in a folding table with side benches invented by John N. Battenfeld of Kansas City, Mo.

The table can be folded and carried easily in the hand, or it can be put in the toolcase of an automobile. The parts are hinged together at one end so that none will be lost. Each seat will hold 1200 pounds.

Outdoor Dressing-Room in a Small Bundle

AN OUTDOOR dressing-room invented by John Bush of Dayton, Ohio, is designed particularly for the convenience of auto tourists.

The room is made by attaching a canvas covering to a steel frame. This



How the dressing-room is folded

collapses into a compact bundle. When set up, a portion of the frame forms a convenient seat in the interior of the little dressing-room.

Electric Hedge-Trimmer Saves Time and Labor

FOR trimming long stretches of hedge where electric current is not available, this portable hedge-trimming power outfit is especially useful. A two-horsepower, air-cooled gasoline engine is connected directly with an electric generator that supplies current for the clipper.

Often it is not convenient on account of terraces or shrubbery to take the generator close to the hedge. For such conditions several hundred feet of extension cord is provided.

The gasoline engine and electric generator are mounted on a small four-wheel

Clipping a hedge with electric power

truck that can be rolled from place to place where it is needed.

It is claimed that with this power outfit from 300 to 500 feet of hedge can be trimmed on the top and sides in an hour.

Automatic Bank Teller Encourages Thrift

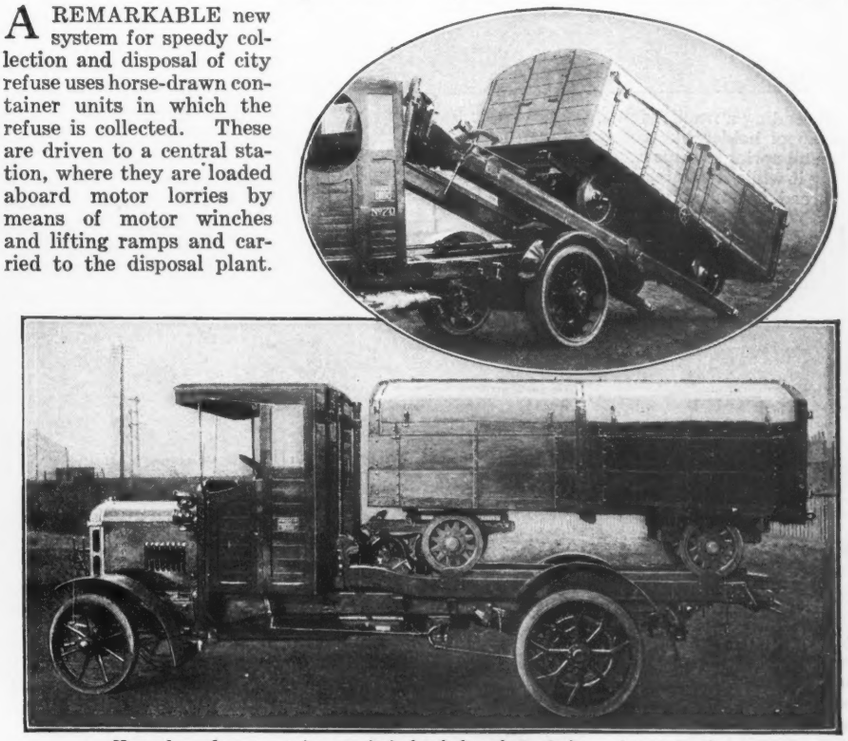
TO ENCOURAGE thrift among its employees, a New York motion-picture distributing concern recently installed this ingenious automatic bank teller in its offices.

The employee deposits whatever amount he cares to save in an envelope, and places it in the machine, receiving a receipt showing the amount of his deposit. This receipt he takes to the bank, where he is credited with the amount of his savings in a bank-book.

The contents of the machine, of course, are turned into the bank.

New System Speeds Up Refuse Collection

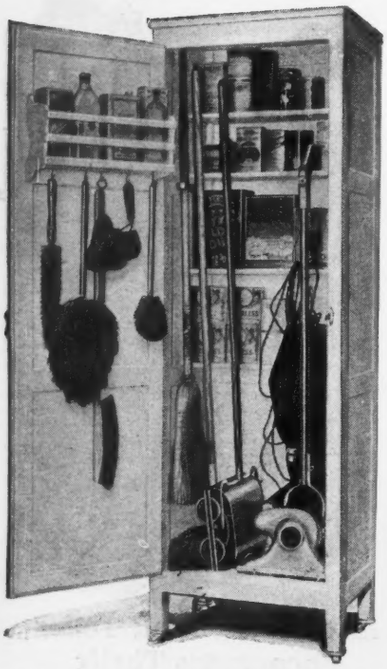
A REMARKABLE new system for speedy collection and disposal of city refuse uses horse-drawn container units in which the refuse is collected. These are driven to a central station, where they are loaded aboard motor lorries by means of motor winches and lifting ramps and carried to the disposal plant.



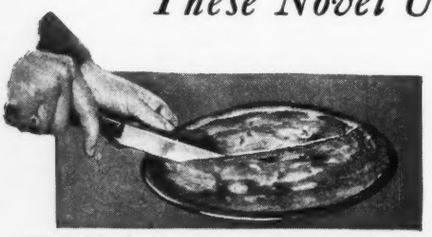
How the refuse container unit is loaded and carried on the motor lorry

Ingenious New Ways to

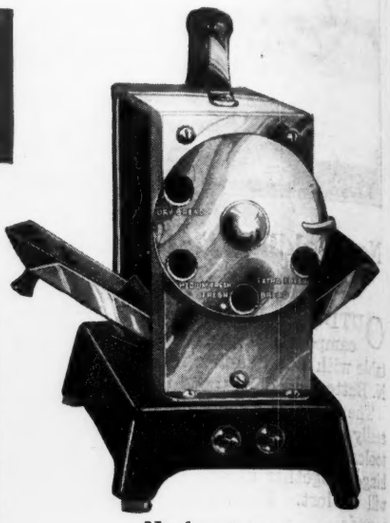
These Novel Utensils and Methods



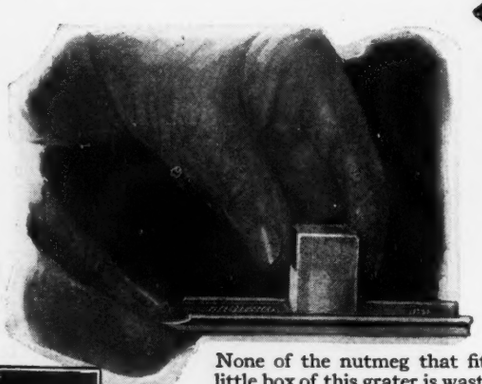
A place for the broom, vacuum cleaner, mops, and other cleaning equipment is found in this convenient kitchen cabinet. There are shelves for soap, oil and powder



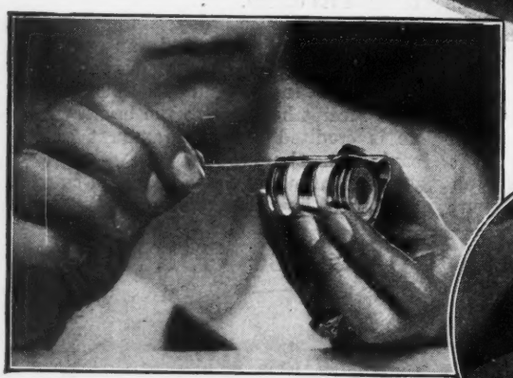
With this new pan there is little danger of burning pies. It is made with a layer of asbestos, which prevents baking too fast



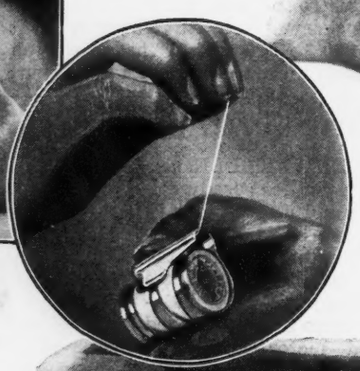
No burnt toast with this automatic toaster. One sets a dial as on a telephone. When it has revolved back to normal position, the wings of the toaster tip back

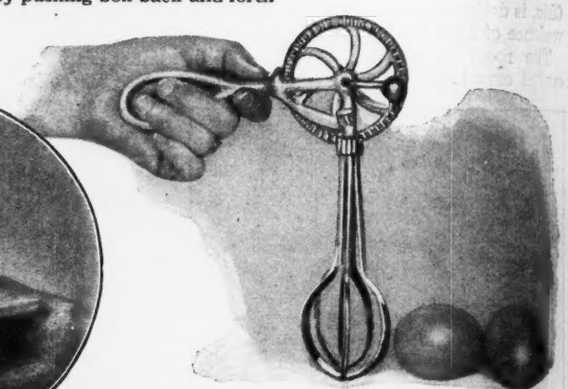


None of the nutmeg that fits in the little box of this grater is wasted. It is grated by pushing box back and forth

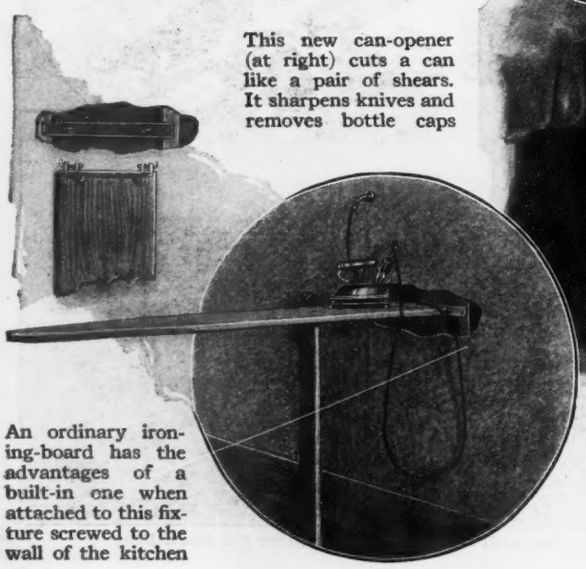


Threading a needle is made easier if one has a spool holder like the one illustrated. A metal spring clamps around the spool, holding it while it rotates. The loose end of the thread is pulled through the needle's eye

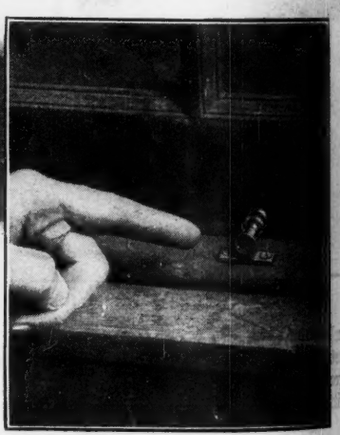




A side handle on this egg-beater, which fits the palm of the hand, makes it convenient to hold. A guard over the large gear protects the thumb while the beater is in use. The large size of the gear ensures speed



This new can-opener (at right) cuts a can like a pair of shears. It sharpens knives and removes bottle caps

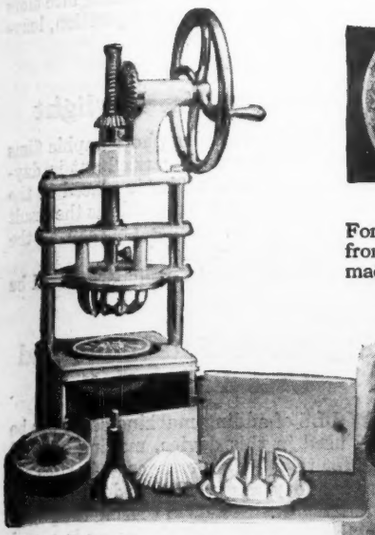


An ordinary ironing-board has the advantages of a built-in one when attached to this fixture screwed to the wall of the kitchen

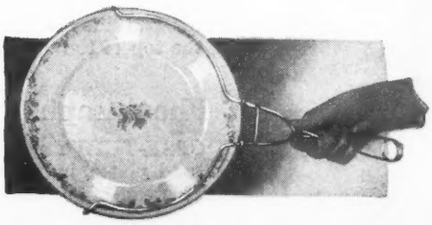
This simple invention, a screw pressed against the window-frame (at right) keeps the window from rattling in the wind. The base in which the screw rests is fastened to the sill

Lighten the Housework

Are Designed to Save Time and Labor



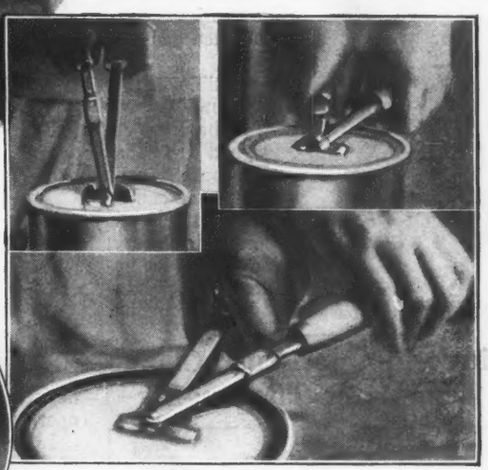
One turn of the crank makes short work of preparing the breakfast grapefruit. Curved knives cut the fruit from the shell and remove the core



For handling hot plates or lifting hot pans from the oven or stove, a folding holder made of two wire grips is convenient

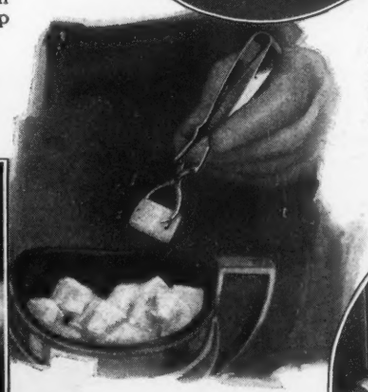
An all-round household servant is this sturdy little electric motor on rollers. One motor for all the household labor-saving devices was the inventor's object

A flat piece of composition rubber glued to a handle makes a convenient powderless knife-cleaner. Knives are cleaned by rubbing



One handle of this opener holds the can in place, while the other cuts the top in a circle. In this way there is no danger of injury

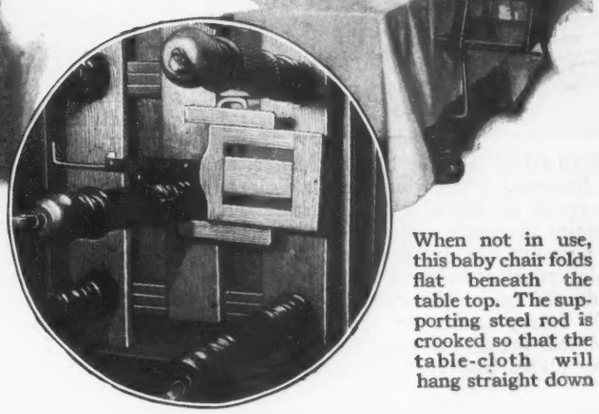
A twisted spring, fitting over the spout, and hooked around the handle of the teapot prevents the lid from slipping and falling into the teacup



Sugar lumps will not drop unexpectedly when in the firm grip of these improved sugar-tongs

A sanitary griddle greaser (above) spreads grease with a piece of material similar to lamp wicking. This can be removed for washing

For keeping windows open at any height the metal window lock at the left was devised. Fastened on the upper sash by means of small prongs, it acts as a wedge when the lower window has to be raised



When not in use, this baby chair folds flat beneath the table top. The supporting steel rod is crooked so that the table-cloth will hang straight down

Handy Frame for Typewriter

© K. & H.

How the hinged frame holds the typewriter in a perpendicular position

FOR the small office where space is limited, a frame attachment for the desk, that lifts a typewriter up and out of the way when not in use, gives more desk room. The machine is fixed to a wood base, which fits in a metal frame. This pivots on fixtures attached to the desk. A steel rod falling into slots in the fixtures holds the machine in an upright position, leaving the top of the desk clear.

Photographs Developed in Daylight

TOPSY-TURVY methods of developing photographic films and plates, by which the process is carried out in daylight instead of the darkroom, and the film is placed in the fixing bath first, then in the developer, are possible as the result of recent experiments made by Dr. Henry Leffman at the Wagner Free Institute of Science, Philadelphia.

The daylight method, using a special developer, should be a distinct advantage.

Rubber Base Is Cushion for Telephone Instrument

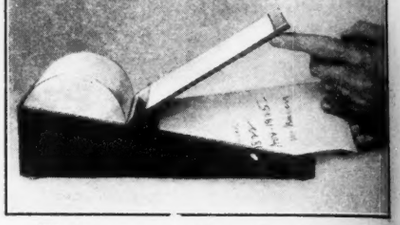
A RUBBER base for a telephone keeps it from skidding on glass-top desks and acts as a cushion to prevent noises and vibration in the phone. The bases are made in several colors to harmonize with office desks or tables.

Fitting the base

A flexible rubber rim around the top of the base is designed so that the base of the telephone can be inserted under it and held firmly, so the device becomes a permanent mounting.

Ingenious Telephone Pad Uses Paper Rolls

ROLLS of adding-machine paper can be used in this device, making a useful pad for telephone messages. As slips are written they can be filed under the cover. A cutting device aids in tearing the paper. On the under side of the cover is a card for recording important telephone numbers for convenient reference.



Placing memoranda under the cover

Useful Slide-Rule Holder

A TIME-SAVER for the engineer is this handy slide-rule holder. The rule is set at an angle at which it can be read easily, and the holder has a rubber base to prevent its slipping on a smooth desk top. Only one hand is needed to operate the rule.

Internal coilsprings hold the upper part of the holder firmly against the rule.

THE high price of olive oil has resulted in the manufacture of numerous vegetable oils as substitutes among which corn oil, one of the newest, ranks with the most important.

Three-in-One Brush Cleans Typewriter Thoroughly

INCLUDING three brushes in one, an improved typewriter brush is designed to reach all parts of the machine that require thorough cleaning. In addition to a general cleaning brush of soft camel's hair for dusting between the keys and type rods and under the carriage, there is a stiff rotary brush for the type and a pointed brush for reaching out-of-the-way places that accumulate dirt.

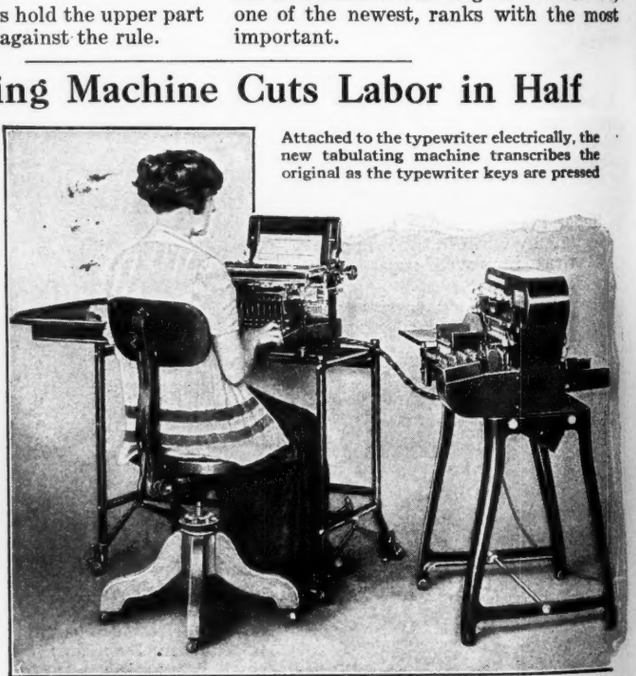
Tabulating Machine Cuts Labor in Half

MACHINE tabulating methods usually have required at least two operations—one of the original entry, the other of transcription to unit item cards.

One of these operations now has been eliminated by a transcribing machine attached to the typewriter electrically and operated by the typewriter keys.

Thus the labor and cost of tabulation are cut in half, it is claimed. The machine can be operated from any light socket.

Attached to the typewriter electrically, the new tabulating machine transcribes the original as the typewriter keys are pressed



How the tabulator is operated in connection with the typewriter

Duplicates without Carbon

TYPEWRITING multiple copies without the use of carbon paper has been made possible by a recent invention perfected by Max E. Melton, an employee of the U. S. Post Office. His device is attached to a standard typewriter. It consists of paper rolls ingeniously arranged so that as the paper is fed to the typewriter platen the sheets are automatically interleaved with duplicating ribbon.

The invention, it is reported, is expected to save the government thousands of dollars a year. The inventor has received a cash reward for his efforts.

Max E. Melton, postal employee, sitting before a typewriter equipped with the ingenious duplicating attachment that he invented. With it, copies can be made without carbon paper

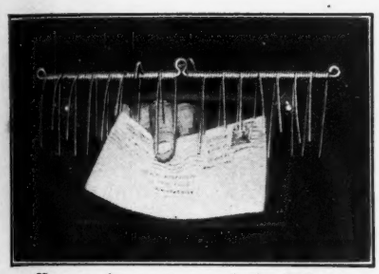
Midget Railway Is Duke's Toy

ONE of the world's oddest narrow-gage railways is owned by the Duke of Devonshire at Eaton, England. It was built in 1894 for the purpose of transporting supplies to Eaton Hall from a station four miles away. Now it is used as a passenger line to transport the Duke's guests about the estate. The gage of the railroad is only 15 inches.

Steel Prongs Guard Mail-Boxes from Thieves

A FAVORITE trick of the letter-box thief is to fish through the slot with a piece of string, on the end of which is a weight smeared with adhesive that sticks to the letters.

To foil his efforts there recently has been devised this screen of steel prongs screwed inside the box just above the slot. The prongs make it practically impossible to pull a letter through the slot, although it is easy enough for the postman to insert the letter.



How steel prongs guard the letters

Flexible Arm Holds Phone

ONE of the ingenious inventions displayed at a recent business exhibition in London was a new telephone attachment that enables a stenographer to have both hands free.

A long, flexible arm, rising from a base on which the telephone instrument rests, holds the receiver to the listener's ear.

This Boudoir Lamp Holds an Alarm Clock

IT IS never too dark to see the time if one has a clock in the base of a lamp. This unique combination of two household necessities is the invention of Mrs. Helen Carr of Buffalo, N. Y.

The clock is provided with an alarm and is so placed that the light above shines upon it.

The lamp is particularly adapted for use in the boudoir as it is made usually in decorative designs such as the one at the right.

Lamp with clock

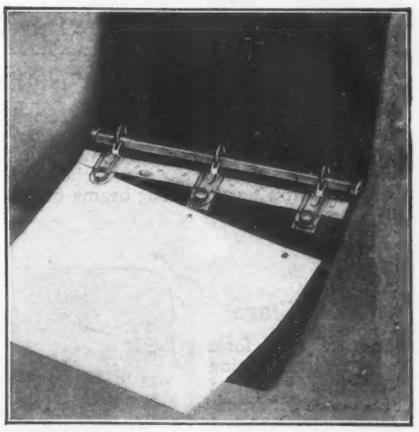
Portable Stool Folds into a Small Box

A FOLDING stool that can be packed into a small case about the size of a cracker box and carried in the hand is adaptable to a wide variety of uses. When unfolded, the legs of the stool are extended to a comfortable height and held firmly by cross braces.

This invention is designed especially for use by artists. It also might be useful for spectators at athletic games, parades, and other events where there is "standing room only." It would be found useful, too, at picnics, lawn parties, or indoors. It is light to carry and can be packed in a moment.

The folding stool in use (left), and packed in its case

This Simple Paper Punch Simplifies Binding



PUNCHING holes in filing sheets in such a way that the ring fasteners of a binder will fit into them exactly without bulging the paper is a troublesome task that has been simplified by this convenient punching device. The result has been obtained by three small punches sliding along a rule by which the correct distance between them can be measured accurately.

Useful Inventions

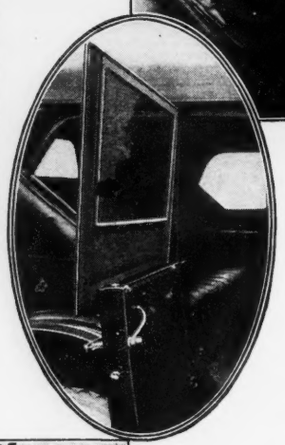
New Time-Saving Tools

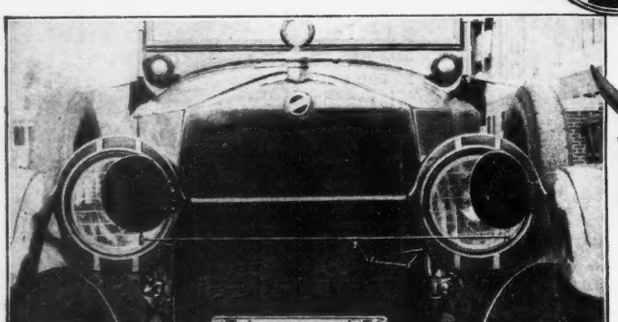
Tire-Changing Simplified

Changing tires on the road is simplified, it is claimed, with a newly invented rim lock consisting of a working lever that can be attached to any rim. A pull on the lever reduces the circumference of the rim and releases the tire

Windows Replace Side Curtains

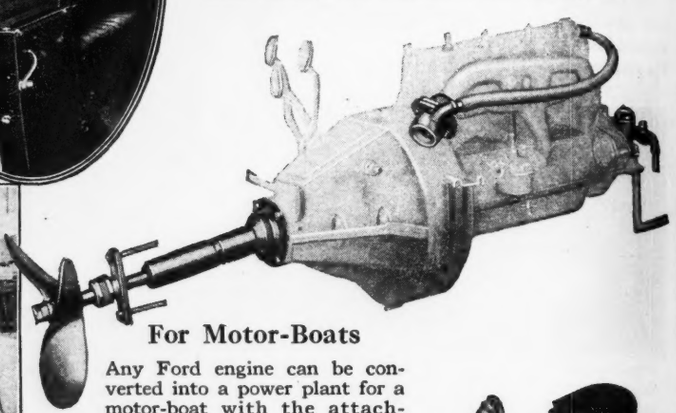
Clear, unobstructed vision on all sides is provided by a new type of inclosure for open cars in which glass window panels replace the usual celluloid side curtains of the touring-car





Light Deflectors for Night Driving

Night driving is made safer, it is claimed, with these new deflectors, which turn headlight beams from the left to the right side of the road. They are controlled from the dashboard, so that when another car approaches they can be moved instantly, throwing the strong beams of light against the curb

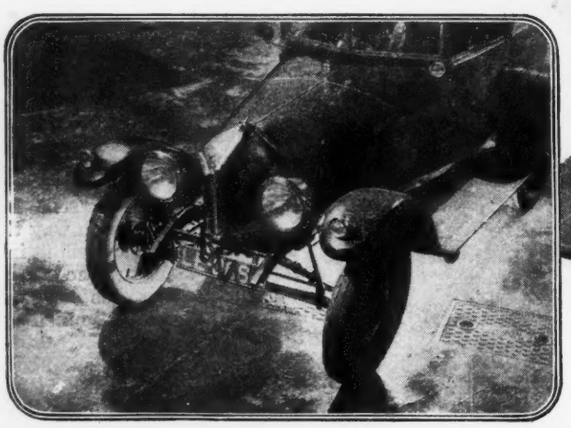


For Motor-Boats

Any Ford engine can be converted into a power plant for a motor-boat with the attachments shown above, including a propeller in place of the fan

Anti-Glare

Another new form of anti-glare lighting system consists of five lamps with magnifying glasses placed directly under the body of the car. The lamps cast direct rays on the road beneath the vehicle, throwing the car into clear view from all sides. Dim headlights are used with the magnified lights

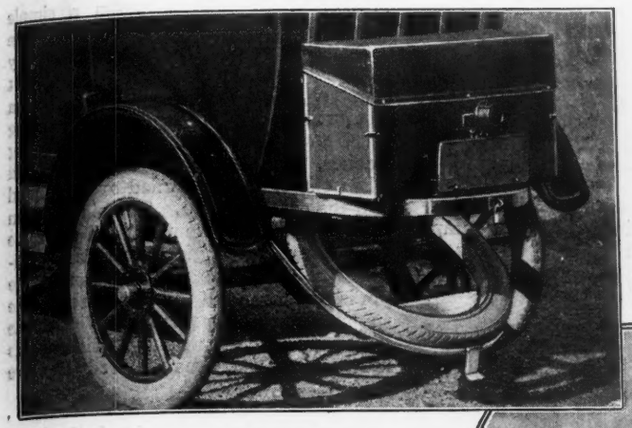


New Mechanical Tire-Changer

This speedy tire-changer for garages consists of three jaws provided with hooks that grip the rim. When the jaws are moved inwardly, the split rim contracts, thus releasing the tire

for the Car-Owner

and Handy Accessories



Trunk, Bumper and Tire-Holder

Auto trunk, rack, tire-holder and bumper all are combined in one compact unit in a newly devised attachment for the small motor-car. It is attached by means of steel arms fastened to the frame of the car by shackle bolts

Inflator and Gage Combined

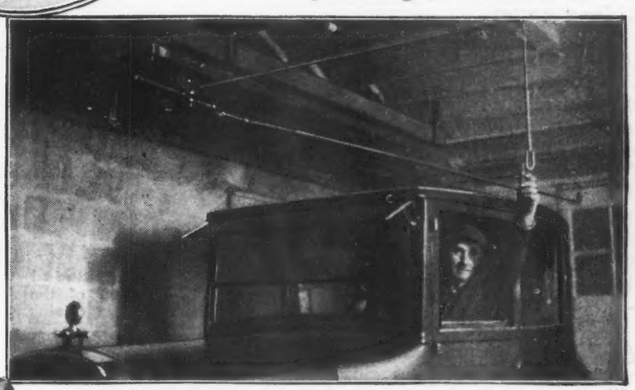
Air pressure in tires is measured automatically by a newly invented inflator that has a small pressure gage that is easily read inserted in the air-delivery tube

One-Finger Hood Lock

A new hood lock of the eccentric type permits the lock to be operated easily with only one finger, so flexible is it

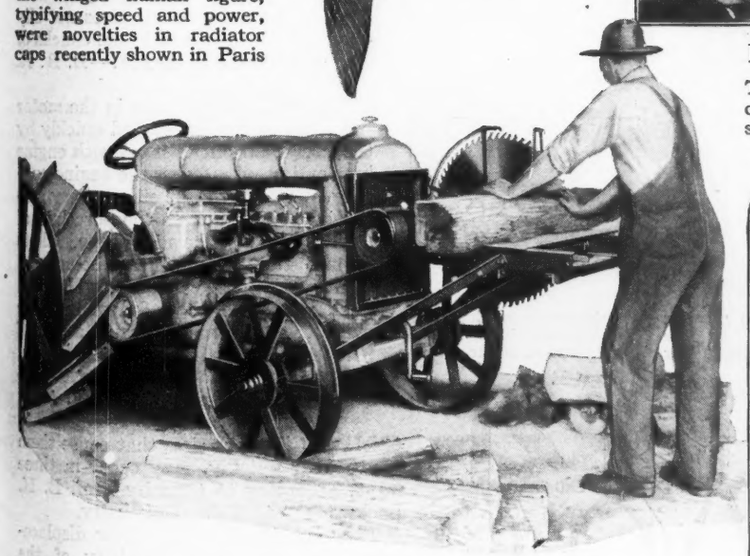
Odd Caps

The tugging bulldog, the graceful crane in flight, and the winged human figure, typifying speed and power, were novelties in radiator caps recently shown in Paris



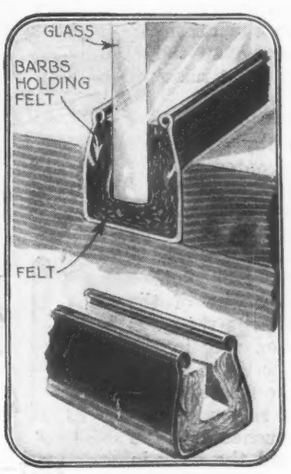
Electric Switch Opens Garage Doors

This ingenious garage-door opener consists of pull chains that operate an electric switch. This in turn starts or stops a motor that operates the doors



Heavy-Duty Saw Driven by Tractor

Here is a heavy-duty power saw that can be attached to a Fordson tractor in five minutes, the makers claim. The ring is supported from the front axle and the heavy saw is driven by pulleys from the engine



No Rattling

The demand for noiseless, non-rattling windows for closed cars has brought about the development of a felt-lined channel for frameless glass (at the left). The cushioning material within the metal channel is held in place by small barbs punched in the sides of the channel, as shown in the diagram, and thus prevents rattling

Time-Saving Kinks for Car-Owners

How You May Solve Common Auto Problems

DID you ever stop to think what a tiresome job it is to cut the paper wrappings away from a new tire—especially when on the road and time is at a premium? Figure 1 illustrates a quick method the writer observed being used in a garage by an expert tire-changer. He simply held the tire a couple of feet from the ground and then slammed it down as hard as he could. This was repeated several times at different points on the tire, and the paper wrappings broke and fell off.—L. B. R.

Fig. 1—By bouncing a wrapped tire forcibly on the ground, the paper is broken quickly

ON MY desk is a warning circular from an insurance company to keep a garage door open when running a motor in the garage. As there are occasions, during chilly weather, when it is not comfortable to work with the doors open, I have installed a light-weight pipe, of tin or iron, as in Fig. 2. This may project through the door or the side wall. It is set over the end of the exhaust pipe of the auto. The small opening through the door can be protected against heat by a supporting collar, and the opening may be closed when not in use by a pivoted or sliding cover.

With a vent device of this kind, one can idle his engine indefinitely without danger. Furthermore, in winter a small unheated garage can be warmed through running the engine.—C. D. DIVINE.

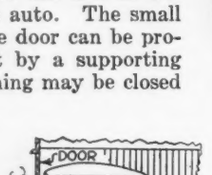


Fig. 2—Outlet pipe carries off exhaust gases when engine is idled in the garage

A FRUIT peddler, using a Ford one-ton truck with an inclosed cab, utilized the simple but ingenious scheme shown in Fig. 3 to operate the engine choke without taking his eye off the traffic or his attention from the wheel.

When he drives through heavy traffic with a cold engine, instead of leaning forward to choke the carburetor, he merely bears down on the cord with his left elbow. That raises the choke rod.

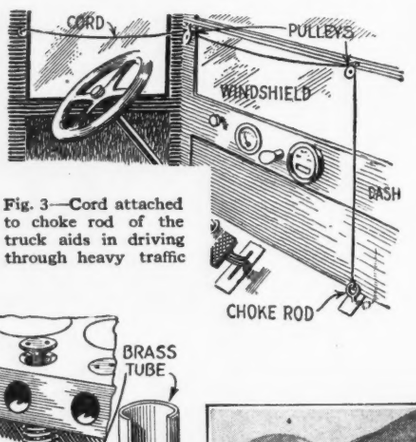
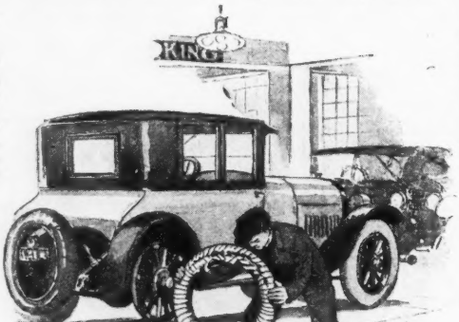


Fig. 3—Cord attached to choke rod of the truck aids in driving through heavy traffic

WHILE overhauling my car recently, I was confronted with the problem of inserting the pistons into the cylinders. I tried the stunt shown in Fig. 4, with success.

A piece of fairly heavy wire was twisted to form a loop at each end. One loop was placed over one of the cylinder-head studs. The wire then was wrapped around the piston ring in the manner indicated. By inserting a screwdriver into the loop at the free end and prying against a stud, the ring was compressed and the piston pushed into the cylinder. This method did the trick in surprisingly short order.—C. M. W.

IF A valve lifter is employed in regrinding valves, sometimes the spring jumps out and one has a "picnic" trying to replace it. Figure 5 shows a simple device I use, which allows the valve to be removed without a lifter and without any danger of the spring's jumping out. It is merely a piece of brass tubing with a slot cut out of its side. When the tubing is slipped under the spring-retaining washer, it holds the spring compressed when the engine is turned over by hand and the cam dropped. The pin then can be removed from the stem, and the valve taken from the engine block for examination. When the valve is ground, the pin is replaced, and the cam raised. The tubing then can be removed. This simple little device, you will find, will save as much as half the time required for valve grinding.—W. M.



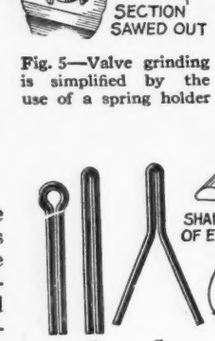


Fig. 5—Valve grinding is simplified by the use of a spring holder

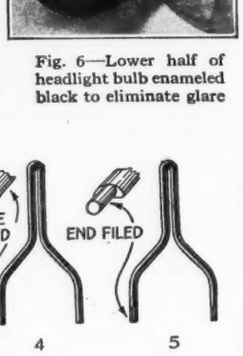


Fig. 6—Lower half of headlight bulb enameled black to eliminate glare

BY ENAMELING black the lower half of each headlight bulb, the headlights on an automobile can be made to give a brilliant light without any dangerous glare (Fig. 6). The principle is that the light radiating from the bulb strikes the upper half of the headlight mirror reflector and then is reflected to the road.—K.B.C.

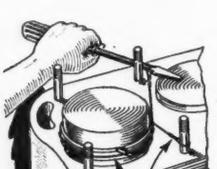


Fig. 4—Using a piece of heavy wire to compress a piston ring

IN FIG. 7 a method is shown for adapting a heavy split cotter key to serve as a valve-grinding tool.

The sketches 1 to 5 show the order of operations in making the grinder. The cotter is held in a vise while the tips are filed. Care must be taken to file the tips square, not beveled, as a square corner does not slip out. The tool is held in the chucks of an ordinary bit brace.—E. B. R.

COMPRESSION leaks in the motor of a car can be located quickly by the use of an oilcan filled with engine lubricating oil. With the engine running, place a drop of oil on every suspected point, such as the porcelain of a spark plug, on the edge of the gaskets around the cylinder-head bolts, and similar locations. The leak will reveal itself when the oil is drawn into the cylinder and burned, because a puff of smoke will show itself.

This simple method will prove effective when other expedients fail.

SLIPS of the rear tires that cause them to wear quickly, may occur in three ways, according to tests by Prof. E. H. Lockwood of Yale University.

They may be due to a slow displacement caused by the elasticity of the rubber, to an abrupt jump when the tire momentarily leaves the road, or to a spin or skid when the tire loses its traction on a slippery road.

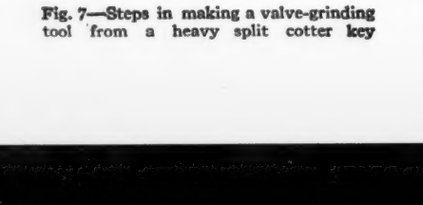


Fig. 7—Steps in making a valve-grinding tool from a heavy split cotter key

Important Things I Have Learned about

YOUR CAR

How to Save Big Repair Bills by a Few Simple Precautions

As Told by a Garage Owner

A FEW days ago a car-owner from out of town paid me a bill of about $125. The bulk of the work for which the charge was made consisted of reboring a scored cylinder and refitting it with piston and rings. To me, though, the most interesting item on the bill was the last, and one of the smallest:

"One fan belt and fitting same, $1.25."

For neglect to supply that car with a new fan belt—even a new lacing might have been enough—was the cause of all the trouble.

The owner of the car had noticed that the metal lacing of the belt was cutting through the leather—a sure sign that sooner or later they would part company—but instead of replacing the belt, or the lacing, he merely tightened up the belt with the adjusting device. This, of course, just put an additional strain on the weakening leather, and one day the lacing cut clear through the belt, and the fan ceased to revolve.

THIS happened somewhere on a country road. Just where, the owner doesn't know. Eventually, though, he saw steam issuing through his hood, and when he got out to investigate, he found that a couple of gallons of water had boiled off from his radiator, the steam being forced out through the lower hose connection. He had no materials with which to make repairs—not even a piece of wire—so he attempted to hold the fan belt together with a couple of hairpins that he borrowed from his wife.

You can guess how long that "repair" lasted! By various makeshifts he managed to get the car to within a few blocks of my garage. Then the car stopped because one piston was "frozen" by expansion to its cylinder. That, of course, was the cylinder we had to rebore.

Neither was that an extreme case. Rather, I'd say, after handling many thousands of cars in the last several years, it was almost typical. For in nearly every case where a car is brought to this shop for extensive repairs, the fault lies not in the automobile itself, but in the ignorance or neglect of the owner. There is probably no article of equal value in the world that is treated so carelessly and so recklessly as the average automobile.

Take the matter of lubrication. There are some 60 essential parts of an automobile that require either oil or grease at intervals that vary roughly between every few days and every few months. Every car-owner has received from the manufacturer an instruction book that explains by means of a simple pictorial diagram just where and just how often oil or grease must be applied to the car. Oil companies also send out similar charts, and publish booklets and advertisements telling exactly what grades of oil and grease are required by different makes of automobiles to get the best results.

Where You Can Save Money

Don't let the dust gather in this corner of your garage. By following the lubrication chart that comes with your car and applying oil and grease where and when the chart specifies, you will save yourself a lot of unnecessary trouble and expense and keep your car in use longer

There is, in fact, no reason why every car-owner should not know everything about lubricating his car, which is a simple job, though not the most pleasant in the world. Not more than three cars in 10, though, as far as I can judge from those I see, are properly lubricated.

Not long ago one of my customers noticed that the oil gage on his dashboard was not working. He was in a hurry to go somewhere, so he paid no attention to what should have been a warning. He got through the day without mishap, and continued to drive his car for about a week. Then one day the car began to behave like a bucking broncho, and he brought it round to us for an inspection.

The reason the oil gage hadn't worked was that the pump gears were worn, and, of course, oil hadn't been circulating through the motor. If he had brought the car to us immediately, we could have repaired it for about five dollars. As it was, though, it cost him more than $100 in labor and materials to replace burned-out bearings.

ANOTHER man heard a little noise in the rear of his car and paid no attention to it, even when it grew louder. In fact, he didn't run the car into the garage until it showed unmistakable signs of readiness to quit for good and all. We took down the transmission, and found what might be described as a pile of powdered steel sawdust.

It's almost unbelievable, yet this man, who had an instruction book telling him to fill his transmission case with a certain grade of grease every 3000 miles, had never inserted an ounce of grease in the two years he had owned that car. Small wonder that the gear teeth began to break off, circulate through the mechanism, and "chew up" everything within reach! His repair bill was about $75—and less than a dollar's worth of grease would have saved it all!

Another man paid me around $30 recently for a new spring and for resetting the spring on the opposite side that went out of shape when its mate broke. Another case of failure to lubricate! Any mechanic could have spread and oiled that spring in 15 minutes when it first began to squeak.

I sometimes think it's too bad that most cars aren't equipped with non-adjustable carburetors or with some kind of locking device that would make it

impossible to change the adjustment, once it was made by a competent mechanic. Haphazard tinkering with carburetors by people who don't know what they're doing causes more trouble than you'd ever imagine. I wish I had a small percentage of the cost of the gasoline that's consumed unnecessarily every year, due to improper carburetor adjustments!

The carburetor is easily accessible and you need no tools to monkey with it. For that reason it's usually the first part of the car that the average inexperienced driver starts to play with when his car begins to run badly.

A man in my town bought a second-hand car a few months ago. It was in good condition, and he drove it without trouble for several weeks. Then one day on the road the motor began to lose power and to miss and cough. The owner didn't know what to do about it, and was standing by helplessly when another motorist stopped beside him and asked if he could help. The man who was in trouble explained what had happened, and the other, without making an inspection or a test of any kind, announced immediately that the trouble lay in an improper carburetor adjustment and that he could fix it.

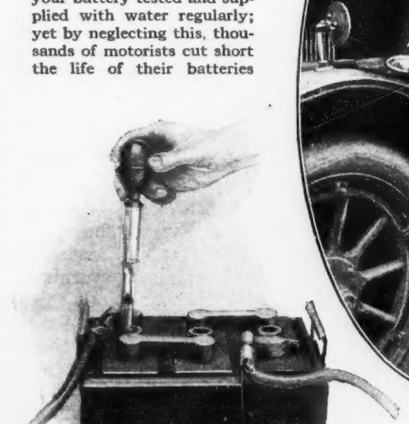
HE DID fix it, too. He gave the gas adjustment a couple of turns, and the car immediately began to hum like a racer. The owner completed his trip, then when he got home, related his experience to a neighbor. This latter had been driving for about a year, so, of course, "knew everything about automobiles." He decided that he ought to look over the work the volunteer repairman on the road had done, and was very gleeful when he discovered that the filter in the top of the vacuum tank was clogged with sediment.

"See, your trouble wasn't in the carburetor at all," he reported, removing the filter to clean it.

LIKE many amateur repairmen, however, he forgot something—to readjust the carburetor to compensate for the greater amount of gas that was being fed to it through the clean filter. The result—one of them, anyway—was that the owner of the car ran out of gas about a week later 10 miles or so from home. The car had been giving from 15 to 16 miles to the gallon; now, though, with the new carburetor adjustment, it was giving only seven, and he found himself without gas when all his calculations indicated that his tank should have been half full.

Of course, he had to pay for having his car towed in from the road; also for the removal of carbon from the cylinders, for the excessively rich mixture he had been using had caused his motor to carbonize alarmingly. All of that expense and trouble could have been obviated by spending about 75 cents to have that filter cleaned and the carburetor properly adjusted.

Batteries supply an enormous annual list of unnecessary casualties. A good storage battery on a car that is run regularly ought to last for years. Few of them do, however. Not a week ago I replaced a $25 battery that was only a year old. Never once had the owner put distilled water in it, nor tested it, as he might have done with a 50-cent hydrometer. Any garage or battery service station would have tested it for him and added water for 25 cents, or charged it for him when it was necessary for about two dollars.



Test Your Battery

It is a simple matter to have your battery tested and supplied with water regularly; yet by neglecting this, thousands of motorists cut short the life of their batteries

Oil Cheaper

By remembering to keep the crankcase well supplied with oil, you will save yourself the cost of burned-out bearings

He neglected it, though, with the result that, after a few weeks of idleness, the battery proved incapable of turning the motor over. When we inspected it we found its plates so badly sulphated that it was useless to attempt to charge it or repair it. Why any one should prefer to spend from $10 to $40 for a new battery rather than from two dollars to five dollars for needed battery service, I can't understand; yet they do it.

Almost any set of standard tires sold today ought to last for between 15,000 and 20,000 miles. How many motorists, though, can boast of getting any such tire mileage? Once again ignorance and carelessness are to be blamed. To get 15,000 miles, at least, out of a tire, it is necessary only to supply yourself with a good gage, to keep the tire pumped up to the pressure specified by the manufacturer, and to repair all small cuts as soon as they occur.

RECENTLY an indignant customer came to me complaining that a cord tire I had sold him had blown out at the end of 4000 miles. I gave him a new tire, but actually he didn't deserve it. On one of his first trips he had gashed the side of the tire by running over a trolley switch. He made a great point of the fact that the blowout had not occurred at the place that was cut. Nevertheless, the cut was responsible, for moisture, entering the fabric through the break, had traveled along within and settled at the place of the blowout, gradually rotting the fabric away until at last a sudden jar caused the rubber casing to give.

Those small cuts, to which the average owner pays no attention, frequently result in expensive tires blowing out before the tread shows any appreciable wear. They are caused generally by sharp stones on macadamized roads, steel slivers in car tracks, and the rough edges of curbstones. You should inspect your tires at least once a week, and if any small cuts are disclosed, the break should be cleaned thoroughly with gasoline and repaired with rubber cement. Either that, or have the place vulcanized.

BACKING into a curbstone may bruise your tires so badly that a couple of thousand miles are taken from their life. Scraping the curbstone may produce a similar result. Misalinement of the front wheels, which causes the tires to wear on the relatively thin sides, likewise soon may make them ready for the scrapheap. A man who keeps his car at my garage recently destroyed an expensive balloon tire because his brake rods were improperly adjusted. The right-hand wheel was doing all the braking, with the result that the tire wore out in record time.

How many cars are ruined almost irreparably every year because ignorant owners drive them too fast when new, I wouldn't care to estimate. The man with his first automobile is more likely to "drive it to death" than the man who has owned cars before.

(*Continued on page 135*)

Know Your Car

REMOVING tires from rims is a dreaded job that bruises hands and ruins good temper. Special tools have been devised to make it easier, but the average car-owner cannot afford them for individual use. He, therefore, leaves his tire-changing work to service stations.

Yet it is possible to do this work yourself easily without special tools if you give proper attention to the rims and lugs. The difficulty of changing tires depends almost entirely upon the condition of these parts, that ordinarily are neglected. To facilitate tire-changing, observe these precautions:

1—Sandpaper the tire bead surface of the rim and shellac it with a thin coat of shellac.

2—Rub the tire beads with flake graphite, applied with a cotton pad.

3—Clean the bearing surface of the rim, the wheel rim and the tire lugs, removing rust, and smear a thin coat of graphite grease on these surfaces, including the bolt threads.

With the surfaces prepared in this way, and the use of a well-oiled jack, tires will slip readily from rims.

Broadcasters Have Troubles, Too!

What happens when a station goes dead in the middle of a program—The inside story of transmission

By Jack Binns

WHAT happens when a broadcasting station stops short right in the middle of a program?

"Must have blown out a tube," says the average radio fan, but he will be wrong in most instances. A blown tube is a mere detail at any of the larger stations.

However, a broadcast station is susceptible to all the ills of a regulation power house, in addition to the many troubles that are peculiar to its own equipment. Reactors or condensers may break down through overloading, or resistors burn out. A hundred and one minor faults may appear in apparatus that is no part of the actual radiation system.

The ideal broadcaster ordinarily has two complete sets of apparatus so that in the event of trouble the chief operator can switch instantly to the spare transmitter. Then he and his assistants can hunt for and remove the trouble in the main set without interfering with the program. The situation was summed up for me by the engineer of one of the big stations in these words:

"THE man is not born who can locate and repair a fault during the actual broadcasting. Broadcasting is like housekeeping—it is necessary to wash the dishes after every meal. We have to go over our utensils two or three times every day to see that they are clean and unbroken."

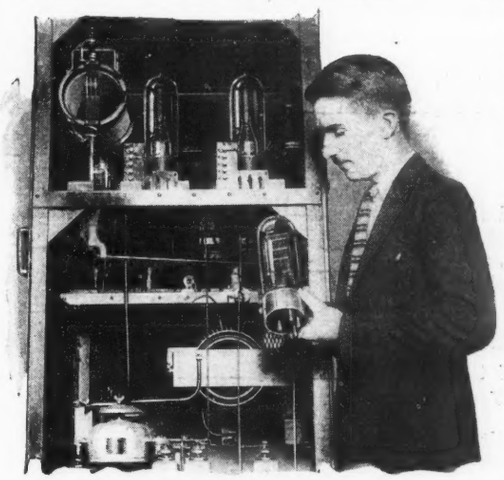
Like earthquakes and cyclones, things do sometimes happen that can not be anticipated or guarded against. For instance, just a few weeks ago one of the big stations in New York City had to shut down right in the middle of the afternoon program.

Something went wrong somewhere and in the twinkling of an eye practically every piece of apparatus in use at the time, clear down to the fuses in the street, was reduced to red hot junk through a bad short circuit. Those who were present say that even the microphone in the studio emitted wisps of smoke, much to the surprise of the artist who was singing into it at the moment.

This was a really serious breakdown — one that would put a small station out of business for several days at the very least. In this particular case the station was on the air again in just 12 minutes.

Broadly speaking, there are three main sources of trouble at a transmitting station. First, in the studio; second, in the transmitter and its associated apparatus; and, third, in the connecting telephone wires that make possible the broadcasting of outside events by remote control.

The chief problem experienced in the studio is in securing audio-frequency currents of correct strength. It is necessary to see that the artist doing the broadcasting is close enough to the microphone to get full volume on the weaker frequencies, and yet not close enough to cause "blasting" on the loud tones. There is the further possibility that some trouble may arise in the voice amplifier or connecting wires to the transmitter, but such occurrences are quite rare.



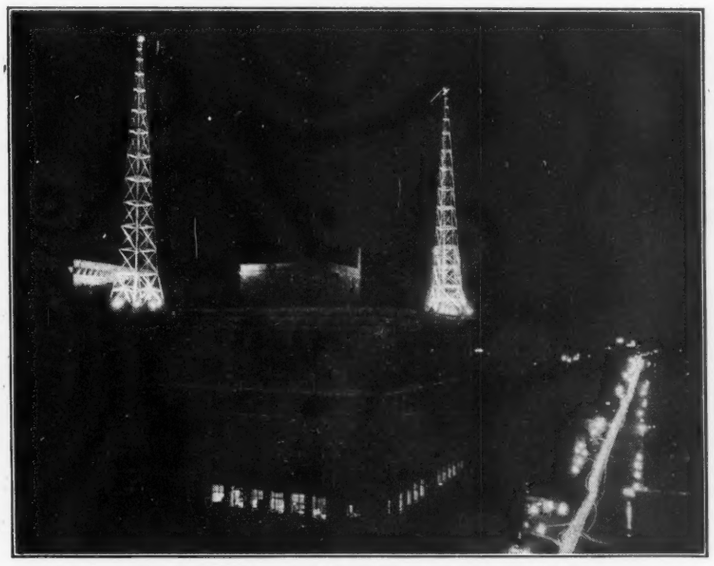
Where Programs Are Sent Out

A 500-watt transmitter, showing enormous power tubes. A blown tube is just one small detail in the every-day troubles of a large broadcasting station

IN THE broadcasting apparatus proper, a number of things can happen, many of which will cause a break in the program. So far as the tubes are concerned, the possibility of filament "blow-outs" is not very great. The engineers have sufficient data on the characteristics of power tubes so that they know when they are being overloaded.

At some of the stations, the power tubes have thoriated filaments. These, of course, may drop in emission while the program is going out, but the result will mean merely a restriction of the effective area of radiation and not a suspension of operation. One of the peculiar tube troubles that may be experienced is an air leak. When this happens a rush of plate current follows and the overload relays will cut out and stop transmission.

The greatest source of trouble in the transmission apparatus, however, lies in the associated instruments used to apply power to the radio circuits. These are common to any electrical power house and may arise in the transformers, motor generators, condensers, or at other points that are working under high voltage. Well designed broadcast apparatus is arranged to provide an ample margin of safety, so as to limit the possibility of disaster.



Illuminated Broadcasting Towers at Night

Remarkable nighttime view of Station WHO, Des Moines, Ia., with broadcasting towers illuminated by floodlighting projectors. Breaking of the antenna during a severe storm may be the cause of a serious interruption in the program

IN STORMY weather there is the additional possibility of the antenna being blown down or breaking under excessive wind pressure. Naturally, this would stop everything until a new antenna could be erected. If the break occurred at night, the cessation would be complete until the following day, for it is practically impossible to put up a large transmitting antenna in darkness during stormy weather.

Since the development of remote control, the life of the station operator has been one of constant worry. At any moment some line trouble may cause an interruption in the program. Yet despite handicaps, remote control has become highly successful.

An Ideal Long-Distance Receiver for the Radio Beginner

How to Build *the* Most Up-to-Date One-Tube Set

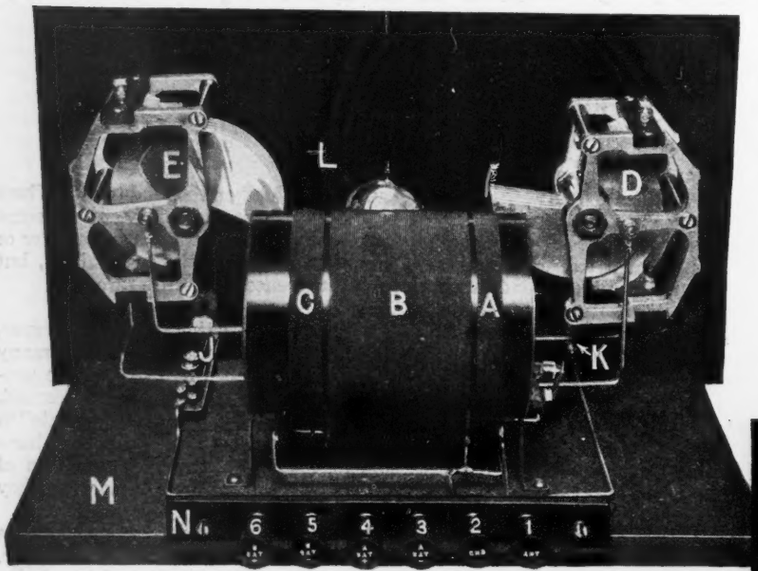


Fig. 1—Rear view of the one-tube set, showing simple layout of parts and wiring. All parts are lettered and numbered to correspond with the wiring diagrams. Notice that the parts are arranged so that nothing is in the active field of the tuning unit *ABC*. You can easily wind this tuning unit yourself by following the instructions in the accompanying article and in an article on coil-winding on page 76 of this issue

Fig. 2—Front view of the panel, showing neat arrangement of the two condenser dials, the rheostat knob, switch, and phone jack

By Alfred P. Lane

THIS one-tube receiver should appeal to every radio fan. It is simple to build, easy to tune, and gives remarkably fine results. Distant stations are brought in with a clarity and volume not exceeded by any other type of regenerative receiver, and in this respect it seems to be better than any of the popular hook-ups. The selectivity is also of a very high order.

All of these advantages are the result of a new method of obtaining regeneration—a way that absolutely eliminates the distortion so common in ordinary circuits when regeneration is pushed close to the oscillation point. With this circuit, added regeneration simply increases the volume right up to the point where the tube breaks into oscillation. The secret lies in the fact that no audio-frequency currents are passed through the tickler coil, so that all regeneration is obtained at radio frequencies.

Distant stations can be brought in with ease when conditions are favorable and the various stations always come in at the same dial settings because regeneration, as obtained in this circuit, has no effect on the wave-length adjustment.

ANY type of tube may be used. The receiver illustrated was carefully tested with six-volt storage-battery tubes, three-volt dry-cell tubes, and 1½-volt dry-cell tubes. Several different distant stations, including KYW of Chicago, could be tuned in with any one of the three types of tubes. In varying the tubes no change was necessary except a slight readjustment of the wave-length dial (at the left) to compensate for the difference in the internal capacity of the tubes, and a new setting for the regeneration control dial (at the right). Of course it was necessary to change the battery voltages to suit the different tubes. The tests were made in New York City in a locality not particularly favorable for radio reception. Storage-battery tubes gave slightly louder signals.

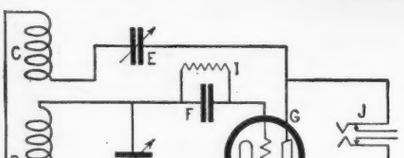


Fig. 3—Complete wiring diagram. For beginners unfamiliar with the radio symbols, a picture diagram will be found on the next page

Blueprints Are Available for This Set

HERE is described the first of a new series of radio receiving sets for the amateur builder—receivers that embody the most up-to-date refinements in radio design, yet are simple and easy to construct.

Blueprints for the new POPULAR SCIENCE MONTHLY one-tube set now are available, and will be found listed in the tabulation of our Blueprint Service on page 107 of this issue.

To supplement this one-tube set, Mr. Lane next month will tell how to build a simple audio amplifier that reproduces with remarkable clarity and volume.—THE EDITOR.

THE construction of the receiver is exceedingly simple. There are no moving coils and the tuning unit *ABC* is easy to wind. This point should appeal to the amateur builder particularly, since there are no special parts to be bought.

You will notice that there are two wiring diagrams. Figure 2 is for the reader who has mastered the use of radio symbols and Fig. 4 is for the beginner who does not know just how to connect the various instruments in the circuit.

The receiver is designed to be used with an outdoor antenna from 75 to 100 feet long. If you are located close to several powerful broadcasting stations where interference between stations is severe, a shorter antenna, or even an indoor antenna, may be used during the early evening, although such an antenna can not be expected to bring in distant stations.

You will need the following parts to construct the set:

A, *B*, and *C*—Tuning unit.
D and *E*—Variable condensers, .00025-mfd. capacity.
F—Grid condenser, .00025 mfd., with clips for grid leak.
G—Vacuum-tube socket.
H—Rheostat.
I—Grid leak, 2 megohms.
J—Double-circuit jack.
K—Filament switch.
L—Panel, 7 by 12 inches.
M—Baseboard, 6½ by 11 inches.
N—Binding-post panel, ¾ by 6 inches.
One piece of hard rubber, composition, or cardboard tubing 3 inches in diameter by 4 inches long.
¼ pound of No 22 double silk-covered wire.
Two 4-inch dials.
6 binding posts, brass brackets, screws, bus-wire, etc.

In going over this list of parts, you will

note that all of them are carried by dealers in radio supplies. The tuning unit *ABC* cannot be purchased complete, but is simple to wind.

Head phones must be used on this one-tube set, although under favorable conditions it will operate a loudspeaker with sufficient volume to be heard in a small room.

In the next issue of POPULAR SCIENCE MONTHLY I will tell you how to build a simple and efficient audio-frequency amplifier to be connected with the receiver shown on these pages.

D and *E*, the variable condensers, can be of any standard make, but the maximum capacity should be as given in order to cover the broadcast band of wave lengths with the tuning unit as specified. Condensers of larger capacity can be used if you have them already, but it will be necessary to reduce the number of turns in coils *B* and *C*. Otherwise the broadcasting stations all will come in on the lower half of the dials. If you want to use larger condensers, Mr. Senauke's article on page 76 of this issue will tell you the correct number of turns for the coils.

IN PURCHASING the socket *G* it might be well to select one suitable for use with standard vacuum tubes of the storage-battery type, for several of the dry-cell tubes are made to fit this socket and adapters can be obtained for the others.

The rheostat *H* should have a resistance of 15 or 20 ohms for use with six-volt storage-battery tubes, 30 ohms for use with three-volt dry-cell tubes, and six to 10 ohms for use with 1½-volt tubes.

The jack *J* is specified as two-circuit purposely, although the two center contacts are not used. Next month, when the amplifier is described, these contacts will be brought into use to carry the energy into the amplifier.

All the other parts can be of any standard make. It will pay you, however, to buy high grade parts where they actually form part of the electrical circuit, as shown in Fig. 4.

If you intend to place the receiver in a cabinet, it is well to purchase the cabinet at the time you buy the parts so that you will be able to fit the panel *L* to the baseboard *M* and into the cabinet before you start to assemble the instruments. If you do not do this, you may find, when you have the set completed, that the standard cabinets will not quite fit your panel. It is much easier to file the panel when there is nothing fastened to it.

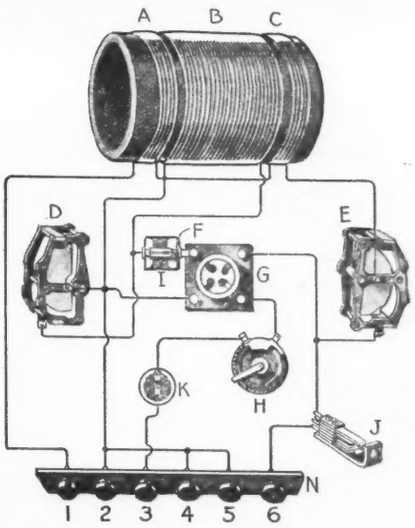


Fig. 4—This picture diagram of the wiring will aid the beginner in assembling the set

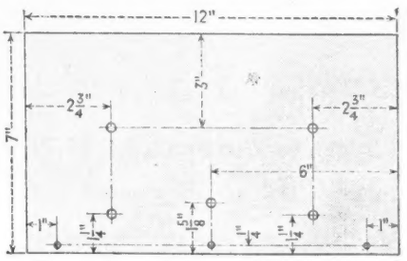


Fig. 5—Panel layout with exact measurements for drilling holes for the shafts of instruments. Use templets for other screw holes

The first operation is to lay out the positions of the holes in panel *L* and drill them in the locations shown in Fig. 5. Only the holes for the shafts of the instruments are given because many instruments now are made single-hole mounting and the ones that require holes almost always are supplied with templets showing where to drill the holes for the supporting screws.

The easiest way to drill the panel is to cut a piece of heavy paper the exact size of the panel and mark off the holes on the paper. Paste the paper to the panel *L* with library paste, then center punch and drill the holes through the paper and panel. The paper can be washed off afterward. This method will save scratching the panel.

Now fit the panel *L* to the baseboard *M* and to the cabinet as described above.

The next operation is to drill 12 small holes in the hard rubber or composition tubing—two for each wire end. Also drill a hole at each end for the screw that holds the tubing to the brass brackets, as shown in Figs. 7 and 8. The object of drilling two holes for each wire end is that the wire can be passed through to the inside and then out through the other hole. This will keep the wire tight. See Mr. Senauke's article on page 76 for suggestions as to how to wind coils so that the wire will be smooth and even.

COIL *A* consists of 12 turns of wire and takes up three-eighths inch of space. Coil *B* has 68 turns in a length of two inches, and coil *C* has 16 turns and measures one-half inch in length. The space between coils is just over one-sixteenth of an inch, which allows enough room for the holes drilled to fasten the ends of the wire.

After you have the holes all drilled, you can proceed to wind the coils according to the specifications in the previous paragraph. All three coils should be wound in the same direction, and each coil should be started at the left end (the nearest end in Fig. 8).

After you have the tuning unit wound, mount it and all the other instruments as shown in Figs. 1, 6, 7, and 8. The brass brackets for the tuning unit and the binding-post strip

(*Continued on page 134*)

Fig. 6

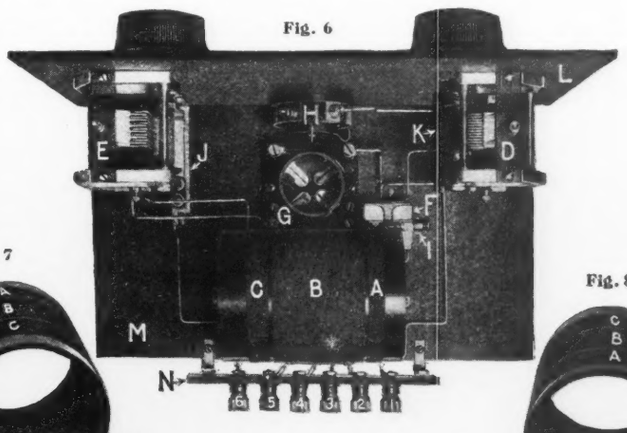


Fig. 7

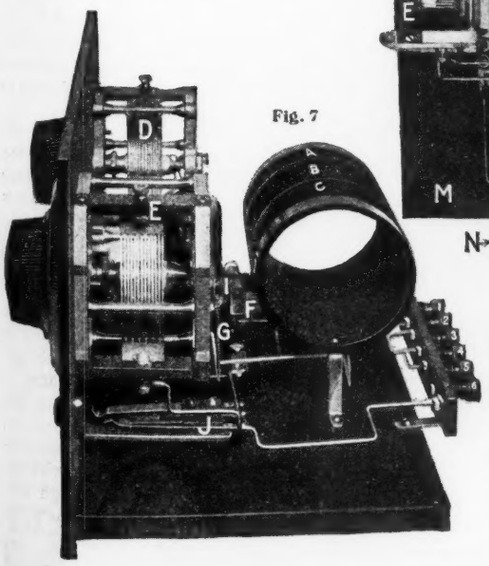
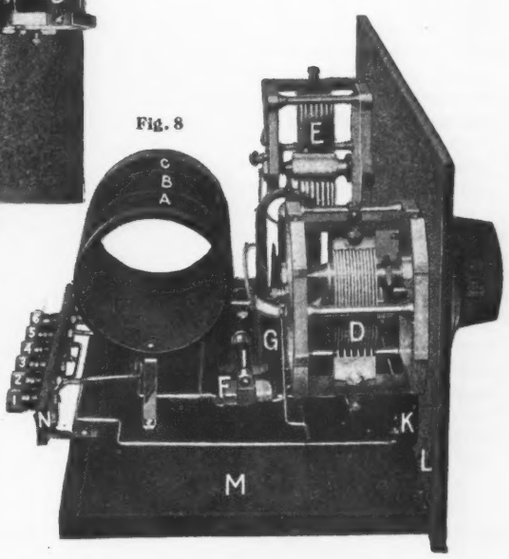
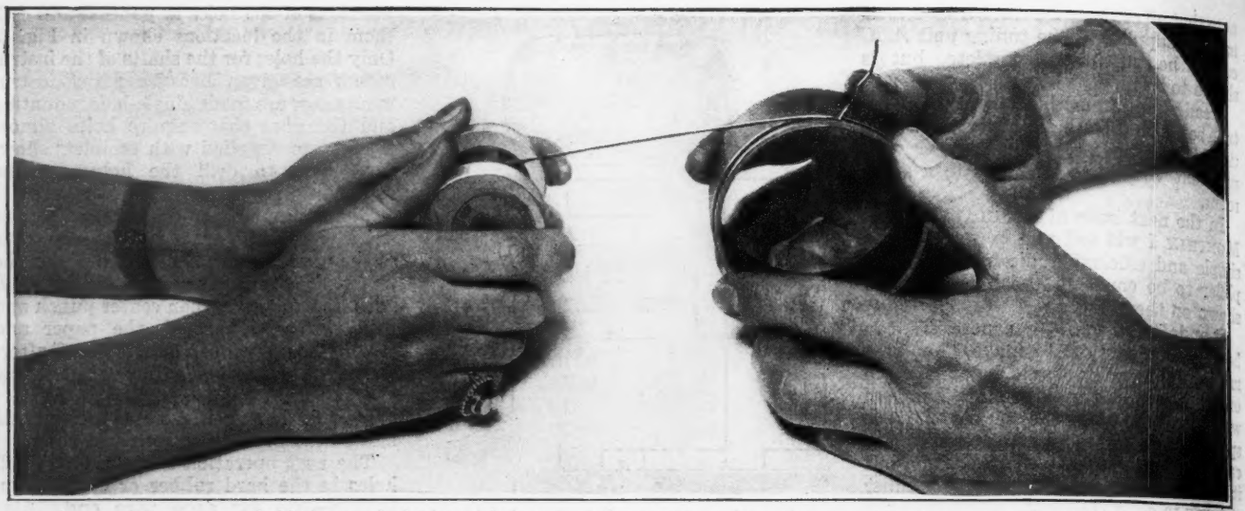


Fig. 8



These three views of the completed set, from the top, the left, and the right, will aid you in laying out the parts and making the wiring connections correctly. In Fig. 6 note particularly how the grid condenser is attached directly to the tube socket. In Figs. 7 and 8 notice how the tuning unit is supported by quarter-inch strip-brass brackets



Let some one hold the spool of wire with just enough pressure to keep the wire taut as you turn the coil form

How to Wind Your Own Radio Coils

Useful Hints for a Neat and Efficient Job

By Alexander Senauke, M.E.

EVERY radio fan who builds a radio receiver at home finds, occasionally, that he is in trouble with the coils for his new set. Either the wave-length range is not right or he has difficulty in winding the coils so that the finished result is smooth and even like a factory-wound coil.

Countless articles have been published that give formulas showing how to calculate the wave-length range of any given coil, but unfortunately the average fan's knowledge of algebra and kindred subjects is rusty from lack of use, and so the formulas are not of much use to him. And, besides, the formulas can give only approximate results, since the maximum and minimum capacity of a variable condenser is not always the same as the figures marked on the outside of the box. Also, no formula can possibly take into account all of the variable factors in ordinary amateur radio construction.

After all, the best way to get at the figures is to determine them by actual experiment. The table on this page gives some of the results I have obtained. In these tests, a standard make of condenser was used, and as you will note from the column headings, the determinations cover the broadcast wave lengths with the two most popular sizes of condenser and the three most popular sizes of tubing.

The tests were made under practical conditions, which means that no attempt was made to obtain an abnormally wide range by reducing the capacity in the circuit. All of the capacity ordinarily present in the average amateur circuit was added before the readings were taken. In other words, there was a socket and a 10-turn primary circuit closely coupled to the secondary, as well as the usual wiring.

In this connection, it is interesting to note that highly efficient, low-loss construction has another advantage besides increasing the signal strength. For one thing, a low-loss receiver, other conditions being equal, will cover a greater range of wave lengths with the same condenser than a receiver having relatively high losses. This is because the usual low-loss construction includes coils having low internal or self capacity, and wide spacing of the instruments and wires, all of which results in cutting down the minimum capacity, consequently making it possible to tune to lower wave lengths.

Now let us consider the various details that affect the possible wave length of any given coil and condenser. To begin with, the test shows what we already knew—that the larger the coil, the fewer the number of turns of wire needed. It also shows that the smaller the coil, the greater the wave-length range attainable with any given size of wire and condenser capacity.

THIS difference is not very important, however. The size of the wire you use is important. You cannot use the specifications for a coil intended to be wound of No. 24 wire and substitute No. 22 with the expectation of getting the same wave-length range. Tests show that the larger the wire, the greater the number of turns needed, so if you use larger wire than mentioned in the table, be sure to add a few turns.

It is always well, by the way, to wind more turns than you think will be necessary, for the simple reason that it is no trick at all to remove a few turns if you find the range too high, while if you find that a few more turns are needed, there is only one remedy and that is to rewind the whole coil.

Tight and close winding will have a marked effect on the wave-length range. The closer any given number of turns is wound, the higher will be the range of wave lengths covered by it when used with the standard condensers. A loosely wound coil with kinky wire usually will require from one to four turns more than standard to make up for the change in self capacity caused by the spacing of the kinks.

A coil wound in sloppy fashion with kinks in the wire will give practically as high efficiency for radio work as a coil

(*Continued on page 133*)

The Number of Turns You Need

THE following table will give you the number of turns required for the secondary coil to cover the broadcast wave lengths, when used with the two most popular sizes of condenser and the three most popular sizes of tubing. In each case the primary should consist of 10 turns wound on the same tube and separated half an inch from the secondary. In the tests on which these figures were based, No. 24 double silk-covered wire, wound on one-sixteenth-inch bakelite tubing, was used.

WITH STANDARD .00025-MFD. CONDENSER

Diameter of tubing	3½ inches	3 inches	2½ inches
Number of turns	48	59	70
Wave-length range	245 to 560 meters	240 to 560 meters	235 to 560 meters

WITH STANDARD .0005-MFD. CONDENSER

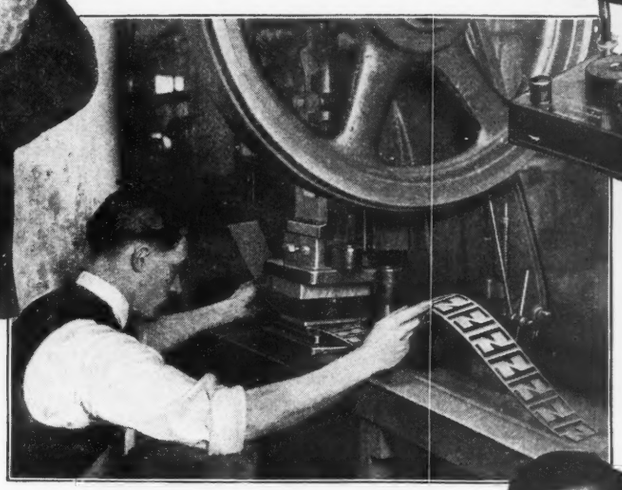
Diameter of tubing	3½ inches	3 inches	2½ inches
Number of turns	36	43	51
Wave-length range	200 to 565 meters	200 to 580 meters	200 to 600 meters

Always Something New in Radio

What Ingenious Fans Are Doing —Useful Devices and Odd Ideas in Construction

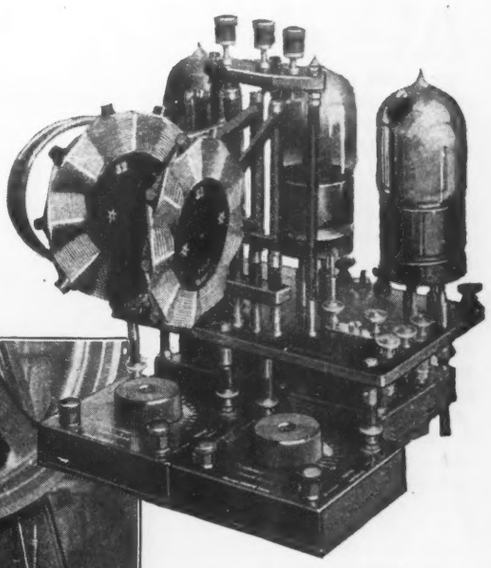
Extremes in Tubes

What are said to be the world's largest and smallest radio tubes were displayed at a recent wireless exhibition in South Kensington, England. Both operate on precisely the same principles, but the large one is thousands of times more powerful than the diminutive model in the exhibitor's right hand



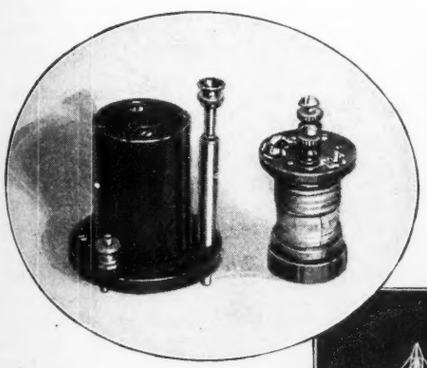
Punching Transformer Cores

Because of the electrical losses of solid iron cores, it is necessary to make the cores of transformers used on alternating current out of many layers of thin silicon steel. Powerful punch presses are used in cutting the patterns, as is shown above



Compact French Set

Here is the French idea of a low-loss radio receiver as worked out by M. Horace Hurm of Paris. Despite its smallness, the receiver includes a regenerative detector and two stages of audio-frequency amplification. It is said to be highly efficient, and its size makes it easily portable. Note the arrangement of the spider-web tuning coils

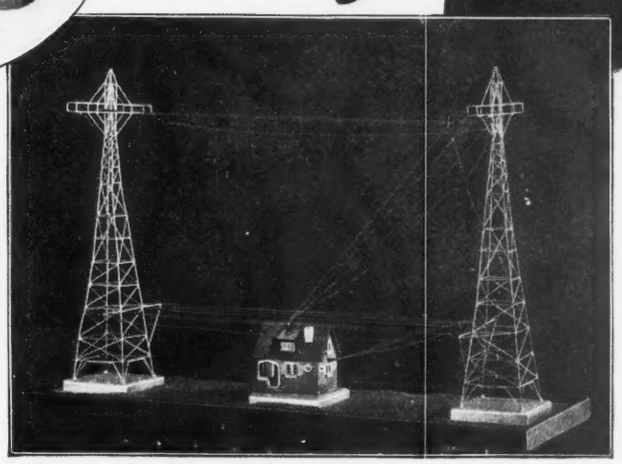


Prevents Radiation

This device, designed to prevent improperly operated regenerative receivers from sending their squeals into the air to annoy the neighbors, is the recent invention of Roy A. Weagant, a well-known radio engineer. It consists of a choke coil placed in series with the telephones and plate circuit of the audio-frequency amplifier, and a small condenser that connects the plate circuit of the audio-frequency tube directly with the grid of the regenerative tube

Milk Panels

Leo Abrams, of Brooklyn, N. Y., won first prize in a recent radio show with a receiver, the panel and dials of which were made of dried and pressed sour milk. The color combinations can be varied to obtain desired effects



Midget Broadcaster

At the left is a miniature broadcasting station built by Sandy Smead, a California radio salesman. It probably is the smallest working model in the world, and can be heard for half a mile

Handy Kinks for the Radio Fan

Time-Saving Tools and Useful Ideas for Set Builders

ANY one who has attempted to start a small screw in a radio set, when instruments and wires are in the way of the fingers, will find a pair or two of homemade tweezers exceedingly useful. They will soon pay for themselves in time and trouble saved.

Figure 1 shows two of the most useful kinds of homemade tweezers for work on radio receivers. As these tweezers are designed only to hold small objects such as screws, and not to exert any great amount of pressure, they can be made of light-weight sheet metal. One-sixteenth-inch-thick sheet brass will do very well, and the size of the tweezers can be made to suit your requirements. A useful length would be four inches. The sides can be half an inch wide or less.

Cut a V-shaped notch in the end of each piece, and after bending each leg of the tweezer into the proper shape, solder or rivet the other ends together. Riveting is the best way, since the heat of a soldering-iron may anneal the brass and take away its spring.

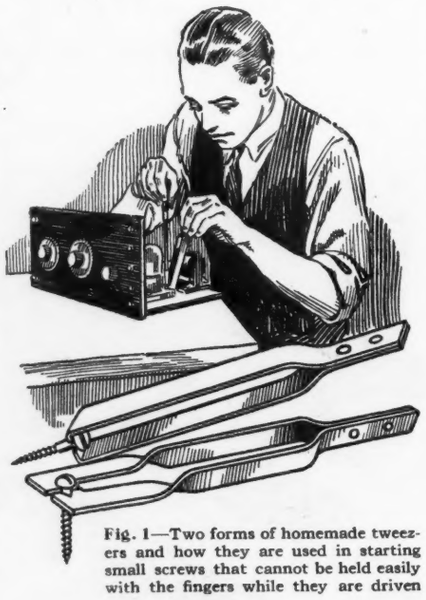


Fig. 1—Two forms of homemade tweezers and how they are used in starting small screws that cannot be held easily with the fingers while they are driven

Right-Angle Screwdriver

OFTEN the design of a radio receiver is such that a number of the screws used to hold instruments in place or to hold the parts of them together are covered up by other pieces of apparatus or the wiring, so that it is impossible to use an ordinary screwdriver to tighten the screws without removing some of the wires or instruments.

In many cases of this kind, the radio fan attempts to tighten up the screws with the edge of a knife blade and usually the result is disastrous to the knife. Pliers may be used, but they are likely to mar the screw head.

It will pay the radio fan who does any amount of radio construction to make a right-angle screwdriver as shown in Fig. 2. By making the angle of one blade square with the handle, and the other turned at an angle of 30 or 40 degrees, you can turn a screw in places almost impossible to get at in any other way.

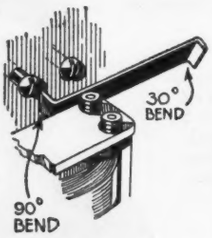


Fig. 2—Where an ordinary screwdriver fails to reach screws in inaccessible places, this simply constructed right-angle screwdriver will be found useful

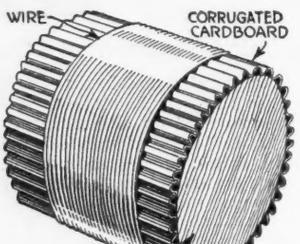


Fig. 3—Efficient low-loss coil wound on a corrugated cardboard form strengthened by thin wooden disk from a cigar box

A Simple Low-Loss Coil

AN EFFECTIVE way to wind low-loss coils if you do not wish to go to the trouble of making a winding form for basket-weave coils is illustrated in Fig. 3.

The coil is wound on a form made of corrugated cardboard, with the corrugated side out. The neatest way to construct the form is to cut out two disks, one for each end, from the top of an old cigar box and then tack the layer of corrugated cardboard to the disks. The cardboard used for wrapping most types of vacuum tubes can be used, although there is some danger that it will collapse at the center. A heavy grade of corrugated cardboard is advisable. After you have the cardboard tacked to the cigar-box disks, dip the whole form in melted paraffin hot enough so that the surplus wax will run off like water when you take the form out. It is a good idea to drill a small hole near the edge of each disk so that the wax that leaks into the inside of the cylinder will run out when you remove it from the pan of melted wax. The idea is to have as little wax as possible remain on the form. The paraffin serves to prevent moisture soaking into the cardboard and also makes the cylinder considerably stiffer.

If you are careful, a very neat and workmanlike coil will be the result. And it also will be highly efficient because the wire will touch the material of the form for only a small proportion of its length.

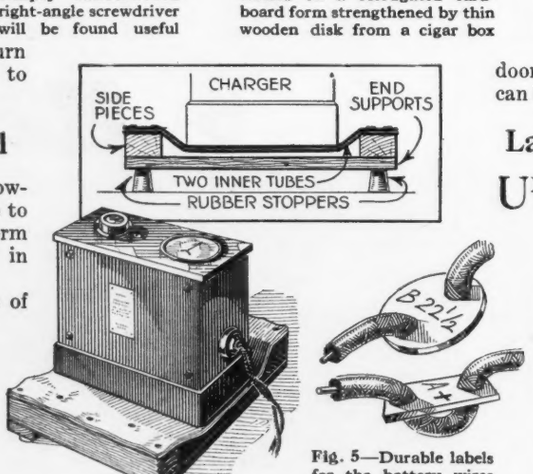


Fig. 4—An effective cushion support to silence the noise of a battery charger is made by stretching a piece of old inner tube across a wooden frame

Silencing Battery Charger

RADIO fans who have alternating current battery chargers of some of the older models, the vibrators of which make considerable noise, have tried all kinds of ways to cut down the disagreeable chattering. Inclosing the rectifier in a padded box often will muffle the noise, but this method is open to the objection that the lack of air circulation causes the battery charger to overheat.

Figure 4 shows how a charger can be suspension mounted so as practically to eliminate objectionable noise and yet cause no harm to the rectifier.

The mounting is made by fastening two side pieces to two end supports, as the drawing indicates. This forms a rigid frame. Next, cut two sections from a discarded automobile inner tube and nail one on top of the other between the two side pieces. This makes an elastic cradle into which the rectifier is placed.

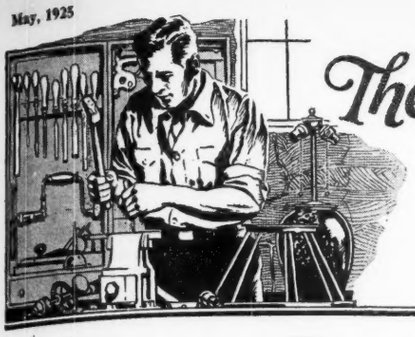
The vibrator still makes a noise, but the rubber prevents the vibration from being amplified by the wood of the floor or table on which the rectifier is placed. Thus, if the door to the next room is closed, the sound can be heard only faintly in the next room.

Label Your Battery Wires

UNLESS your batteries are located directly in rear of the receiving set so that the wires are only a few inches long and it is easy to see at a glance just which wire comes from the minus-A-battery binding post and so forth, it is a mighty good idea to label each wire. Then there will be no chance of mixing them when you have occasion to disconnect the receiver.

Labels of the type illustrated in Fig. 5 can be made easily from stiff cardboard, although a much better material is hard fiber with the designation of the wire stamped in. It is, of course, desirable to place the labels on the wires as near the rear of the radio set as possible.

Fig. 5—Durable labels for the battery wires are made by boring two holes in fiber tags and passing the wire through the holes. Designations for the wires are stamped on the labels plainly



The Home Workshop

Arthur Wakeling, *Editor*

How to Re-Upholster Your Chairs

Simplified Methods of Renovating a Worn Spring Seat

By William T. Weld, Shopwork Instructor, Central High School, Peoria, Ill.

WHEN applied to the repair of upholstered furniture, the old saying, "A stitch in time saves nine," is never more true. Many a good chair that is falling slightly into disrepute because of its sagging seat or frayed covering, can be rejuvenated for a trifling outlay of time and money. Even the wrecks that have been relegated to the attic often can be salvaged and returned in state to their old places in the living-room.

Unfortunately the places at which upholstery first wears out are usually hard to get at without first tearing down the whole and beginning all over again. The sooner started, however, the easier the repair can be done.

If the springs of a seat begin to sag, the webbing or metal strap supporting them has given way. The webbing becomes worn where it is attached to the rails, or the tacks holding it pull out.

Obviously the remedy is to put in a new piece of webbing or to retack the old. The construction of most upholstered seats is such that this cannot be done without removing all the old material. If this is done before the outer cover becomes worn through by the springs or pulls away from the tacks along the edges, it is often quite possible to use this same cover again.

By noting carefully just how the original materials were attached, the sizes, and similar details, while tearing down the old seat, much may be learned and this knowledge applied when you begin the reconstruction.

There are a number of ways in which upholstered seats are built up and many different shapes of chairs. However, the general principles are much alike. By applying the information given here to your own particular job, you ought to have little difficulty in securing good results.

In Fig. 1 you will see how the under side of the chair chosen for illustration appeared when the work was begun. You will note that in this chair the springs were held up by two metal straps fastened to the front and back rails.

To make a more comfortable seat than

(*Continued on page 104*)

Where to Find This Month's Mechanical Features

The Home Workshop
Pages 79 to 82 and 88 to 111

The Shipshape Home
Pages 112 and 113

Better Shop Methods Department
Pages 84, 86 and 114 to 124

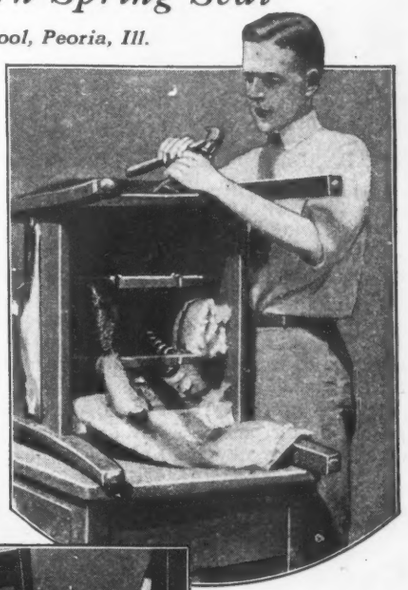


Fig. 1 (above)—Beginning work on an old chair. Note the metal straps that serve to support the seat springs

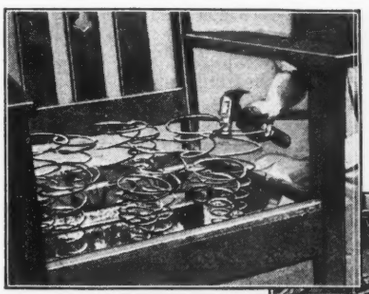


Fig. 2 (above)—Fastening the springs in place. The old springs are nailed securely to the corner blocks; the new ones to the rails

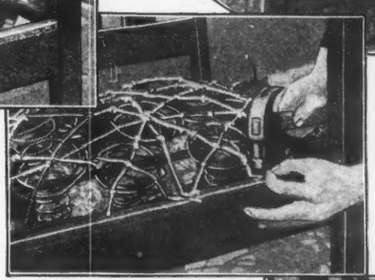


Fig. 3 (at left)—How the springs are tied. The ends of the twine are held fast by tacking

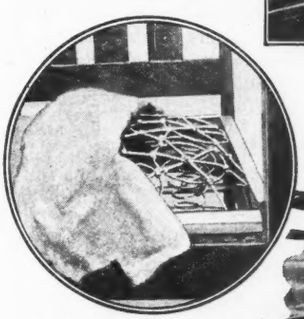


Fig. 4 (above)—Putting on the burlap. The rounded wooden strip makes a better edge

Fig. 5 (above)—The burlap is covered with stuffing tow and a cover of roll sheet wadding

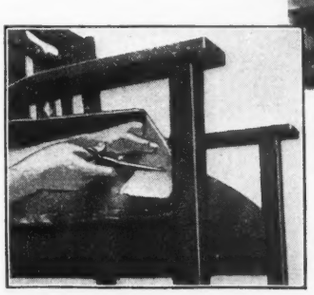
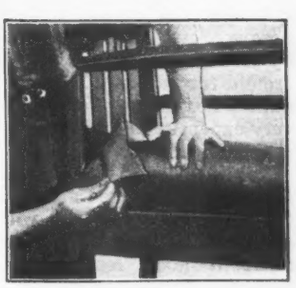


Fig. 6 (above)—The muslin or ticking cover

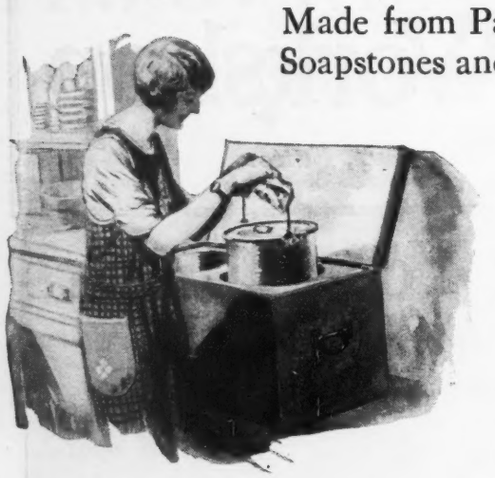
Fig. 7 (at left)—How to fit a corner around a leg

Fig. 8 (at right)—Stretching the final covering



Inexpensive Fireless Cooker

Made from Pails, Sheet Zinc, Soapstones and an Old Trunk



FROM a few odds and ends that are often thrown away or stored in the attic to gather dust, a reliable, money-saving fireless cooker can be made cheaply and easily. I made one in a few spare hours out of an old tin-covered trunk and two peanut-butter pails.

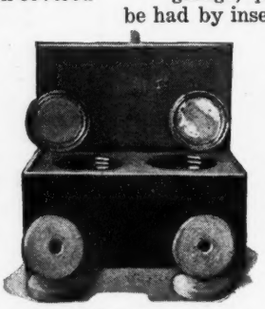
The trunk, a family relic, was about 15 by 15 by 28 in. It was in good condition and so would serve as the container for the cooker without any extra work.

At the grocer's I bought two 12-qt. peanut-butter pails. Next I purchased at a hardware store two pieces of sheet zinc, some asbestos, and four soapstones. These things at hand, I obtained a quantity of sawdust from the shop, together with a few thin boards with which to box in the top of the trunk.

In assembling the parts, I first cut two holes in one sheet of zinc so that they would come directly over the pails when they had been placed in the cooker as illustrated. Next I covered the pails with two coats of sheet asbestos. The lids likewise were insulated with asbestos and then covered with extra pieces of zinc. The zinc was securely soldered to the lids.

This done, the pails were packed in the sawdust and the zinc cover put in place and soldered to the top of the pails. The edges of the zinc were made to fit tightly and turned up about 1 in. at each side. The corners were soldered to make a watertight cover for the sawdust in the body. This completed the bottom part of the cooker. The top was filled with sawdust, boarded up tight, and then covered with the second piece of zinc.

To hold the soapstones over the food while it was cooking, a wire hook was soldered to the cover. Small wire S hooks were found useful between the solid hook and the soapstones.



The cooker open, showing the lids and soapstones

WE HAVE tried out the cooker for more than a year on many different foods and find it to be quite as efficient as any commercial cooker. Care and judgment must be used to heat the stones to the right degree; this done, we have no trouble in cooking roasts of meat and puddings, in baking potatoes or cake, or in having a hot and steaming midday meal ready upon our return from church on Sunday.—H. D. SMITH, Nyack, N. Y.

Register Serves as Ventilator

GOOD ventilation for an attic, barn, garage, pig or poultry house, may be had by inserting an ordinary register, such as is used in warm-air heating, under the eaves or gable ends of the building.

For a trifling sum extra, these ventilators can be obtained with a cord or chain either outside or inside to open or close them below. They can be painted to match the building or can be bought finished in various styles.—C. W. HUBERTZ.

Kitchenette Makes Camp Cooking Easy

By James A. Hoskins

PLEASANT weather for weekend trips and auto-camping is at hand. It is time to overhaul your equipment and, if you have not already done so, provide yourself with an auto kitchenette to assure comfort and convenience in the preparation of your outdoor meals.

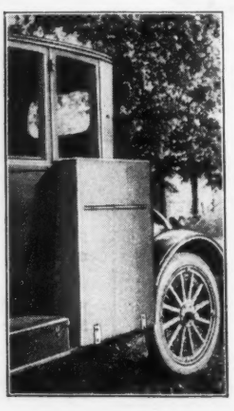
This kitchenette can be made by any high-school boy if he is fortunate enough to be in a school where sheet-metal work is taught. The cost is not exorbitant, however, even if you have the work done by a tinner, although it pays to shop around for estimates. Some commercial outfits no more complete than this are very expensive in comparison.

Wood might be substituted for the metal, but would be somewhat heavier. Basswood, reinforced at the corners with tin strips and covered with strips of metal on the outside, if possible, will make a good looking cabinet when enameled black on the outside and light gray or white inside. The cans may be labeled and painted to match.

It is not necessary to put in all the partitions or to arrange them exactly as shown. Containers used in this case were 1- and 2-lb. coffee tins, 1-lb. square cans that had contained tea, and small wafer boxes for bread and cake. The only metal containers that were made were one for the stove, which also serves as a dishpan, and another in which are stored a kettle, four pie plates, cups that telescope, pans for other cooking and a frying-pan with a folding handle.

The lid of the cabinet opens out for a table that seats two persons on each side and one at the end.

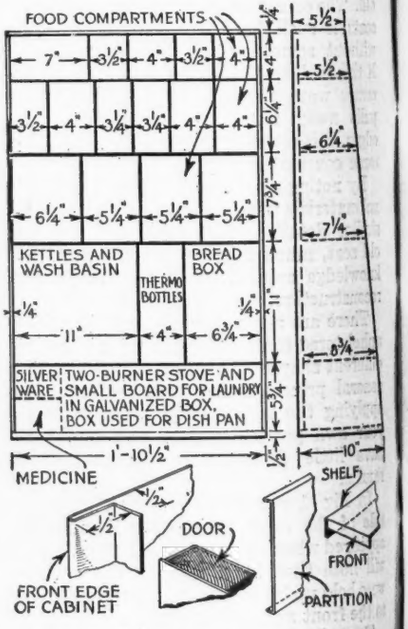
The kitchenette is attached to the runningboard of the car with stove bolts and wingnuts. The author also drilled a hole through the hinge of the door (the hinge is on the back of door) where it did not show and braced the cabinet by running a bolt through.



The width of the cabinet is so planned that it will fit back of the door on a coupé or larger car. The height brings it just below the windows.

The shelves should be riveted and soldered if of metal, and fastened rigidly if of wood. No allowance is made for thickness of shelves if made of wood. The partitions, if steel, need only be

(*Continued on page 106*)



Front and side views of the cabinet and details of the door, shelves, and partitions

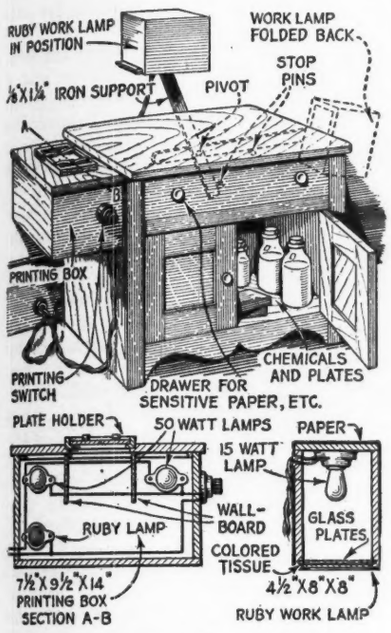
A Cheap Cabinet for Printing Your Photos

Electrically Equipped Work Table Aids in Making Pictures at Home

By Richard C. Tarr

HOME photographers who attempt to do their own work often are at a loss to find a place for developing and printing.

A compact, neat-looking, and efficient work cabinet may be made from an old commode by any one handy with ordinary tools. If a commode is not available, a second-hand bureau, without any mirror, may be utilized.



Old commode converted into photo cabinet by addition of printing box and ruby lamp

The following materials also are required: 4 lamp sockets, keyless; two 50-watt lamps; ½ pint flat white paint and brush to apply it; two 15-watt lamps; one snap-switch; 2 pieces lamp cord, about 8 feet long each; one two-socket "cluster plug"; one piece of galvanized iron ⅛ by 1¼ by about 28 in.; weather-proof wire, size 14, about 4 ft. long, for printing box; a regular 5 by 7 in. printing frame, ordinarily measuring 7 by 9 in. outside, and a few screws.

It is necessary to obtain a wooden box, approximately 7½ by 9½ by 14 in. inside measurement. The box should not be any smaller, but may be larger, only the cover must be made correspondingly larger, to fit. The cover is built up from dimension stock, and should be of ⅞ in. thick pine, whereas the box itself need only be ½ in. thick wood.

SCREW three sockets into place on one side of the box and wire them as shown. The red light, screwed into the lower socket, will enable the photographer to center negatives properly and mask his paper. One wire should run to one terminal of all three sockets; the other wire should run to the other side of the lower, or red-light socket, and thence to one side of the snap-switch. From the other side of the switch run a wire to the remaining terminals of the two upper sockets.

The red light then will burn all the time, and the white light will go on and off as the switch is used. This enables the operator to set his paper by the red light, close the cover of the printing frame, set his time, and turn on the light. When the proper time has elapsed, the white light is turned off, and the paper extracted in the usual manner, for development.

A red light in the printing box helps the operator in placing printing paper accurately

After the printing box is made, give it two coats of flat white paint inside, and allow to dry thoroughly before using. A third coat, of white enamel, may be used; it will give a little quicker printing. As the light is all reflected and diffused by the paint on the inside of the box, the printing is even. The fact that the printing frame is at all times the same distance from the light also assures uniform results.

(Continued on page 109)

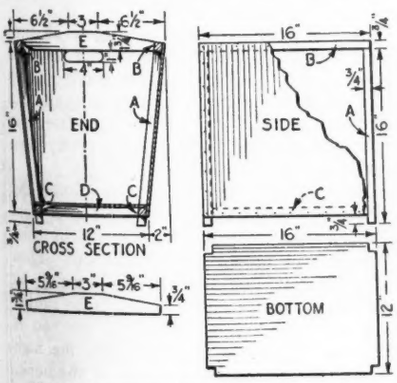
Wallboard Used in Making Neat Waste-Basket

By A. Neely Hall

Specialist on Handicrafts in the Home

BUILT of ample proportions, this wallboard waste-basket is equally useful in office or kitchen. The same design, with the depth, width, and length reduced 2 in. or more, may be used in library, living-room or bedroom.

A piece of wallboard 32 in. wide and 4 ft. long is required for the sides and bottom of the basket, wooden strips ¾ in. square and 16 in. long for corner posts *A* and rails *B*, *C*, and *D*, and a strip ¾ by 1¾ in. out of which to cut rails *E*.



Make and cover two side frames, glue on the end pieces and lastly fit the rails *D* and *E*

The cross section shows the assembly of parts and dimensions for cutting the end pieces. A detail drawing gives dimensions for the wallboard side pieces, and corner posts *A* and rails *B* and *C* to which the edges are tacked. Notice that corner posts *A* project ¾ in. for feet.

Plane up the surfaces of the leg and rail strips and smooth them with sandpaper. Cut the wallboard with a jack-knife or a saw. Sawing is the easier way, and rough edges are removed afterward with sandpaper. Fasten the strips together with finishing nails.

Coat the surfaces of the strips with glue, also the edges of the wallboard that are to come in contact with them. As a reinforcement to the glue, tack the edges of the wallboard with ¾-in. brads.

How the finished waste-basket looks

In laying out the end pieces, draw a center line and measure the dimensions either side of it, so that opposite edges may be symmetrical. The ends of the handle holes may be bored with a 1-in. bit or cut with a knife.

When the end pieces have been cut, glue and tack them to the side frames. Then cut the bottom rails *D* and top rails *E* to fit between the leg strips, and fasten them with glue and brads. Notch the corners of the bottom piece to fit around the corner posts and glue and tack it to bottom rails *C* and *D*.

With the waste-basket assembled, rub down the edges with sandpaper, then give all surfaces two coats of flat paint and one coat of enamel.

How to Make a Chest for Your Small Tools

By William J. Edmonds, Jr.

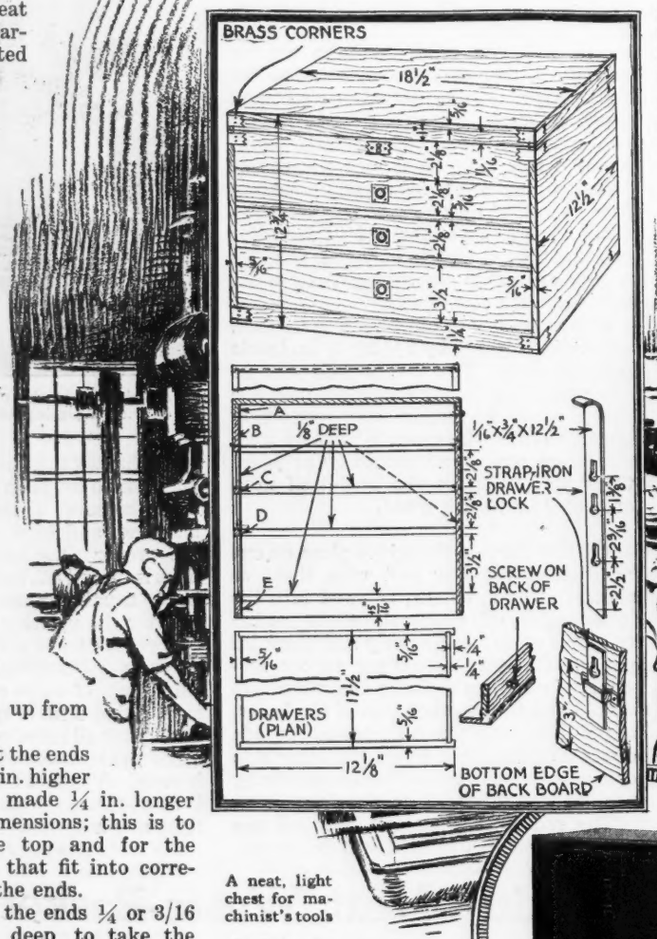
THE amateur mechanic who specializes in metalwork and, indeed, the professional machinist, often wish to build a chest to hold their growing collection of tools. A chest of this type that is of neat and workmanlike appearance, may be constructed by following the accompanying drawings. It might be used, of course, for other purposes, such as for flat silverware, artist's materials, a collection of small curios, and the like.

To build the chest successfully requires first of all a careful study of the drawings. Any good cabinet wood may be used for the case. Prepare 1 piece for the top, 5/16 by 12½ by 18½ in.; 2 pieces for the ends, 5/16 by 12-9/16 by 12½ in., and 1 piece for the back, 5/16 by 12-9/16 by 18⅛ in. Unless wide stock is available, these will have to be glued up from two or more widths.

It will be noted that the ends and back are made ⅛ in. higher and that the back is made ¼ in. longer than the finished dimensions; this is to allow for fitting the top and for the tongues on the back that fit into corresponding grooves in the ends.

Grooves are cut in the ends ¼ or 3/16 in. wide and ⅛ in. deep to take the tongues of the back and front. Although ¼-in.-wide grooves were used in the chest illustrated, 3/16-in.-wide grooves are much easier to make and serve the purposes just as well. Either ¼- or 3/16-in.-wide grooves or 5/16-in.-wide dadoes are made in the side pieces ⅛ in. deep to take the tongues of the bottom and the top tray and the drawer runners, as shown in the end elevation.

The bottom of the top tray is 5/16 by 18⅛ by 11⅞ in.; the drawer runners are 5/16 by ⅜ by 11 7/16 in. They may be tongued to fit the grooves in the side, as in the chest shown, or simply let into 5/16-in.-wide dadoes, according to which method is preferred. These pieces are glued and nailed with small brads in their proper places. The two small front rails, *C* and *D*, are ¾ by 5/16 by 18⅛ in. and have tenons cut in their ends to fit the grooves in the end pieces. The bottom rail, *E*, is 5/16 by 1¼ by 18⅛ in., and also is tenoned into the ends. *A* and *B* (left as one piece at first) are 13/16 in. wide and 18⅛ in. long with tenons at the ends.



A neat, light chest for machinist's tools

The whole case is assembled with a good grade of hot cabinet or warmed liquid glue. After this is thoroughly hard, a line is scribed around the four sides 1 1/16 in. from the top. The cover then is cut off on this line and the edges of the two parts are fitted carefully together. This method of construction, together with the unusual lightness of the case and the absence of difficult dovetail joints, are outstanding advantages.

The corners of the case are reinforced with 12 brass angles and a brass escutcheon plate to match is used to cover the keyhole. A chest lock and two brass butts also are required.

The drawers are made as shown and provided with flush drawer pulls.

The three drawers are locked by means of an iron strip made as detailed and fastened to the back of the case with a metal strap in such a way that it can slide up and down. A round-head wood screw is screwed into the back of each drawer, the head being allowed to project sufficiently to engage the slots in the iron strip. Pushing down this strip locks the drawers, provided they have been pushed in as far as they will go.

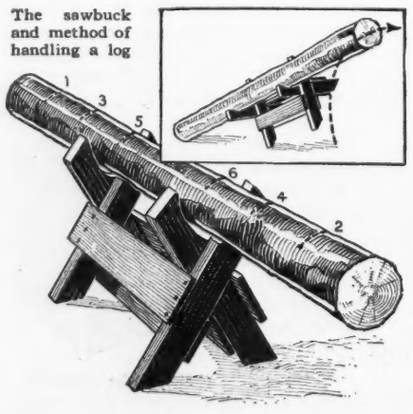
The interior of the box may be lined or not, as the builder prefers. The exterior may be varnished, as the chest shown, or covered with imitation leather.

Strong Sawbuck Lightens Work of Handling Heavy Logs

THE inverted V between the lower legs of the sawbuck illustrated makes it exceptionally strong and rigid. If made of hard, heavy wood, it will hold as large a log as two men can handle. The buck also has the upper part clear for the passage of the saw and it can be made long enough for a piece equal to two sticks of the finished wood to lie across its horns. This allows the last cut of a long stick to be made almost as conveniently as the first.

In sawing heavy logs, much time can be saved by balancing the log on the sawbuck, as shown, and marking it off into stove-wood sections, beginning at the larger end. This means less wasted effort if a short piece must be cut to make the length come out even. Cut first from the end that seems a little the heaviest; then cut from the other end.

The sawbuck and method of handling a log



In placing a heavy log on the buck, lay the buck on its side with the top against the log as nearly as possible in the position it will occupy when set up. Then take hold of one end of the log and, by combining a lift and a push, raise the log and buck together. By this method it becomes unnecessary to lift the log high enough to go over the horns of the buck.

—C. R. VAN DRUFF, McLouth, Kan.

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Better Shop Methods

How Expert Mechanics Save Time and Labor

Old Bill Works on Teeth

And Shows Dependable Ways to Make Gears Quickly

By James Ellis
Machine-Shop Superintendent

OLD BILL was standing beside one of his lathes watching the chips roll off. It was a pleasing sight, but the machinist seemed to be thoroughly disgusted with himself, the machine, and the big casting he was starting to turn. Old Bill recognized the trouble.

"If you will slow down the lathe, and take a cut about half an inch deep, you will get under the scale with one cut," Old Bill said. "Grind the tool this way."

Old Bill made some motions in the air, but the machinist understood them to mean that the tool ought to be shaped somewhat as is shown in Fig. 2.

Old Bill could see some one coming through the shop door hurriedly from a truck outside.

"I need some help," the customer said. "Come out and look at this gear and tell me how long you will be in making another one."

Old Bill peered at it over the edge of the truck—a cast-steel pinion about 12 in. in diameter and 8 or 9 in. in face. The teeth were about 2½ in. pitch and the bore was something like 6 in. The teeth had not broken, but had worn thin and bent over.

"Why don't you send to the factory for another one?" Old Bill asked.

"It will take at least two weeks to get another, and I can't wait that long," replied the other man, who identified himself as the superintendent of a building job near the city. "This is on the most important steam shovel that we have, so you can see how much time means to me!"

"BUT," Old Bill said, "if I make you one, it will cost you about three times as much as one from the factory."

"Can't help it!" the superintendent replied. "I must have one now!"

"All right," Old Bill returned. "I'll see what I can do, but it is a pretty large order that you are handing me!"

Old Bill measured the gear with his rule. He remembered that he had a piece of old shaft about 14 in. in diameter. He sent a couple of men to get this into the shop so that a piece could be cut off. Then he counted the teeth in the pinion—15—and decided that the gear had been 2½ in., circular pitch.

Having started a machinist to roughing out the blank, he took himself to the office to decide what the size of the gear had been when it was new. He multiplied the number of teeth by 2½ and found the pitch circumference to be 37½ in. Dividing by 3.1416 gave him 11.93 in. as the pitch diameter. He drew a circle of this diameter on a sheet of drawing paper (Fig. 1).

He consulted one of his handbooks to find the proportions of gear teeth of 2½ in. circular pitch. He found that the addendum, or length of tooth outside the pitch line, was 0.7957 in., so he added twice this to the 11.93 and drew a circle 13 33/64 in. in diameter. He instructed the machinist to turn the blank to this size. He found that the depth of tooth below the pitch line should be 0.9207 in., so he drew another circle inside the pitch circle 10 3/32 in. in diameter.

Fig. 1—Quick method of laying out the teeth of a large gear for relatively coarse work

Then he stepped off the 15 teeth on the pitch circle. He made the thickness of the teeth one-half of the pitch or 1¼ in.

Next, he drew a horizontal line from *C* through *E*, tangent to (that is, just touching) the pitch circle. Another line, *AB*, was drawn through *E*, the point of tangency, to make an angle of 15 deg. with the horizontal. Another line was drawn from the center of the circle to *D*, making an angle of 15 deg. with the vertical center line of the circle. These two new lines intersected at *F*. He drew a circle concentric with the pitch circle through this point *F*. He called this line his base line.

Old Bill set his compasses to the distance from *E* to *F* and drew an arc, using the point *F* as a center. This was the curve that he was going to use for the teeth from the base line to the outside diameter. Below the base line their flanks would be radial. Now, with this radius, he drew in the curves of all the teeth, and made the flanks radial. He rounded the bottoms of the teeth, where they joined the smallest circle that he had drawn.

Old Bill knew that this scheme he was using was not strictly accurate, for he was making the working part of the gear tooth an arc of a circle, whereas it should be a part of an involute. He also knew that the machining methods that he was going to use would not be capable of much refinement. And, further, he knew that the pinion had had cast teeth when new, so that they could not have been as accurate to shape as he was making his.

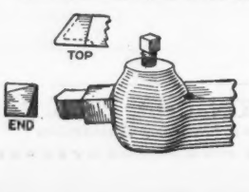


Fig. 2—A toolbit ground according to Old Bill's instructions for getting under the scale of a casting

HIS scheme for laying out the teeth was one that he had learned many years ago. It could be applied to gears of any size with equally good results. The reason for taking 15 deg. for the angle was that most gears were made to work at a pressure angle of 14½ deg. His 15 deg. was just an approximation of this.

He carefully cut the outline of the teeth with scissors, and laid the templet on his desk. He was going out to the shop when another little problem came up.

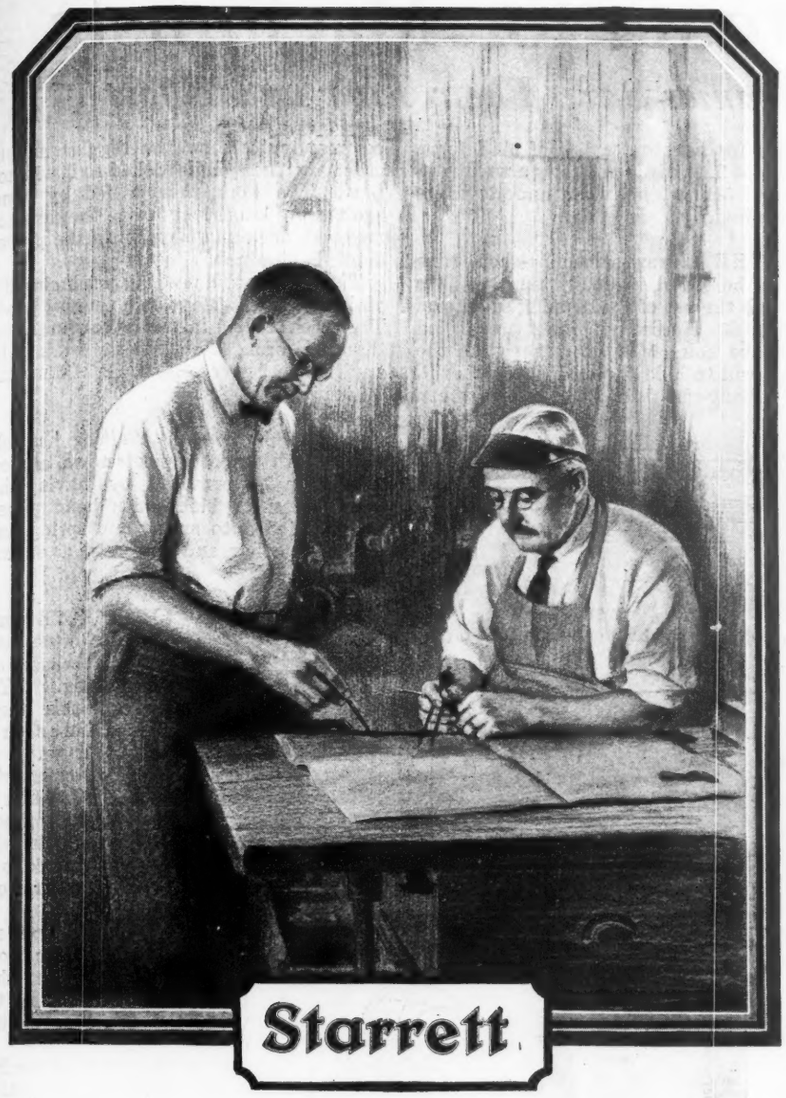
"Can you make me another like this?" asked a man who had just come into the office.

Old Bill looked at it and replied, "Sure!"

It was another pinion, but smaller. It may seem a far cry from a pinion with

(*Continued on page 118*)

MANY time-saving shop ideas will be found in the continuation of the Better Shop Methods Department, on page 86 and pages 114 to 124.



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Shop Shortcuts for Machinists

How Expert Mechanics Save Their Time and Effort

IN FIG. 1 is shown a simple and accurate way to bore unusual tapers in a lathe not equipped with a taper attachment or where the taper is too long for the compound rest to reach the full length without shifting.

The first step is to establish by calculation a ratio of advance of the cross-feed screw with a lead screw. For a taper of ¼ in. to 1 ft. and 18 in. long, I found this to be 3/16 in., which is one-half the ¼-in. taper for 18 in. Additional figuring showed that the screw would have made three-fourths of a revolution.

I fitted one of the change gears to the cross-feed screw in place of the handle and wrapped thin leather around the gear to make up the required circumference of 24 in. A short piece of steel tape connected this gear with the back end of the lathe. One end of the tape was fastened to the rim of the gear and wound once around; the other end was held with a small bolt passing through a hole in a piece of old iron pipe, which was clamped across the ways in back of the tailstock. A wing-nut on this bolt provided adjustment for taking up the slack in the tape.

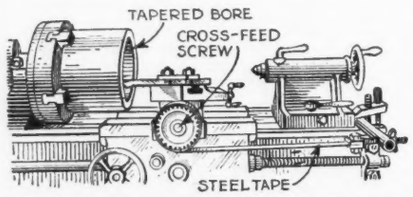


Fig. 1—Simple method for boring large taper

Fig. 2—Combination drill and countersink

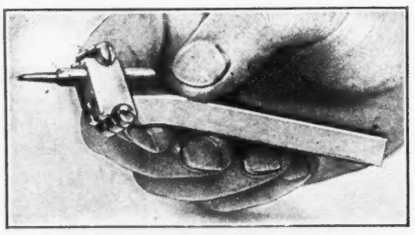


Fig. 3—Small adjustable lathe tool-holder

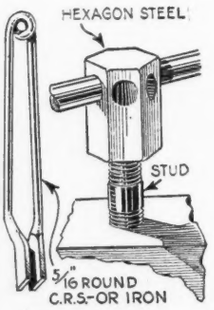


Fig. 4—Shop-made tong and stud driver

After setting the tool in the usual manner for boring, this rig bored large tapers without any trouble.—WALLACE REES, Bell Island, Newfoundland.

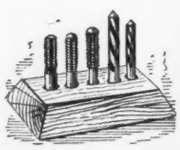


Fig. 5—Time-saving holder for tapping set

THE drilling and countersinking of many screw holes may be speeded up by making the combination tool illustrated in Fig. 2. The countersink is cut off about ½ in. above the head and drilled through to suit the drill. A setscrew is used to hold it at the right depth for the holes.—T. C. DANIEL, Washington, D. C.

TO AVOID packing underneath the tool in doing small jig and die work in a lathe, I devised the adjustable tool-holder shown in Fig. 3. A swinging arm is fastened to the round end of the shank by means of a screw, and the tool itself can be moved back and forth.—GEORGE BENDER, New York.

SMALL tongs, handy for light work, may be made from cold-rolled steel or round iron (Fig. 4). Both ends of a length of rod are forged before the bend is made. The round loop at the handle end gives sufficient spring to keep the jaws open.

The stud driver, also illustrated in Fig. 4, is made from a short piece of hexagon steel. It is drilled and tapped to suit the size of the stud and holes are drilled for inserting a bar of steel for a handle. The hexagon allows a wrench to be used for turning, when more leverage is required.

IN THE average machine-shop time can be saved in many tapping jobs through the use of the tapping set shown in Fig. 5. Hardwood blocks are drilled with five holes 1/32 in. larger than the body drill to hold three taps, a tap drill, and a body-size drill. The crib man can check out the whole set on one tool check instead of three or five.—H. W.

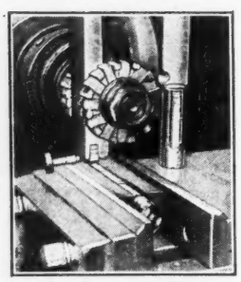


Fig. 6—"Knurling" a rack

A SUITABLE and inexpensive rack and pinion for small parts such as often are used for fine adjustments in microscopes and astronomical instruments, may be made by the knurling process.

The parts shown in Fig. 6 are made with a straight fluted cutter ¾ in. in diameter with 5/16-in. face, having teeth of 90 degrees included angle. The cutter has a ¼-in. hole and is supported on a tool-steel pivot in a soft machinery steel shank 1 by ⅝ by 7 in. The cutter may be either of high-speed or tool steel.

A block, open on one side to permit the passage of the knurl, and with a hole to fit the tube to be knurled, is gripped within a milling-machine vise, set so that the work will be parallel with the cutter arbor. A plug is inserted within the tube to take the pressure of knurling. The knurling tool is held between a pair of common cutters on the regular milling arbor and the spindle locked so it will not turn. The work then is fed by hand against the knurl lengthwise the distance required, back and forth, until the proper depth is obtained.

The same tool is used for producing the pinion, this being done on an engine lathe. The stock is held in the lathe chuck and the knurl brought against the work as in any knurling process.—O. S. MARSHALL, Springfield, Vt.

IN SHOPS where the shafting has collars with projecting setscrews, a good cover can be provided by having the handy man or blacksmith bend pieces of discarded auto spring and spring one over each collar and setscrew, as shown in Fig. 7.—F. C.

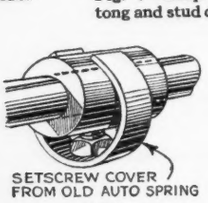


Fig. 7—Safety cover for exposed setscrew

SENSITIVE bearings often are ruined because of overheating. To prevent this they sometimes are painted with a chemical, mercuric iodide, which changes color from scarlet to bright yellow when raised to a temperature of 250° F.

This temperature, while not enough to injure the bearing, is sufficient to warn the operator of its overheating.

The substance, as a rule, is obtainable only from the large scientific supply houses, but it can be made from common, drug-store chemicals as follows:

Seven drams of bichloride of mercury are dissolved in as little water as possible in a clean glass dish or tumbler. The same is done with 10 drams of potassium iodide, and the solutions are mixed. A scarlet powder forms in the liquid. It is allowed to settle and the excess solution is poured off. When dry, it is mixed in gum solution and applied to the surface around the bearing. The paint is permanent and the color change reverses on cooling.

Some care must be used in handling the chemicals, as bichloride of mercury is poisonous.—CHARLES D. TENNEY.

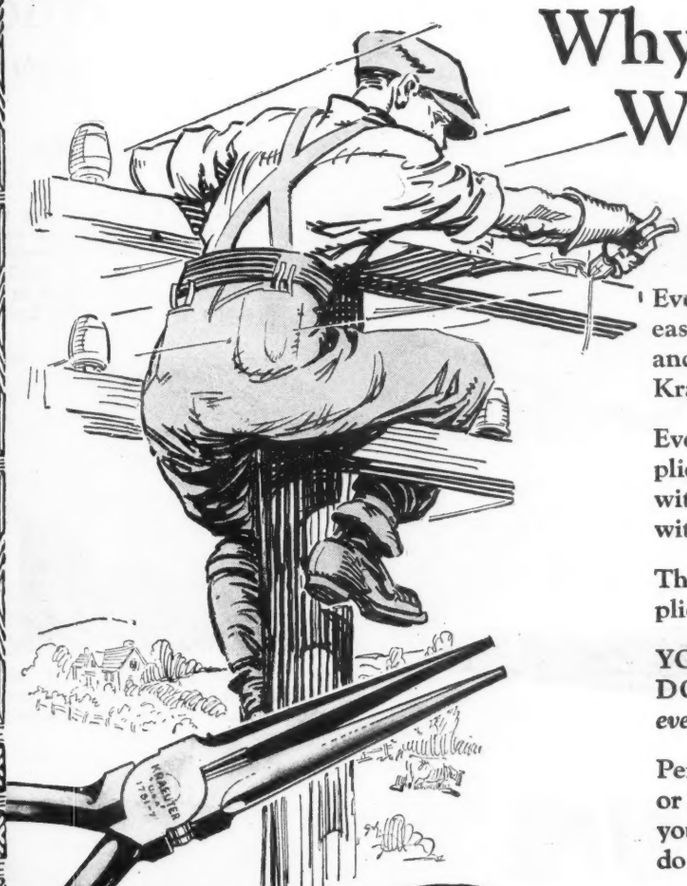
A GOOD oilstone or hone is worthy a good case. Let the lower box be of oak, cherry, or mahogany. For an oilstone that is 1 in. deep, 1½ in. wide, and about 6 in. long, make a box about 1⅛ in. thick, mortised ½ in. for half of the stone, in order that it will fit tightly into the box and be held at a true level.

The cover should be made similarly and be mortised to give a tight, dust-proof fit.

The greater efficiency of the oilstone will repay the trouble of making the box.

KRAEUTER & CO.

Why the Lineman Wants Kraeuter Pliers



Every lineman wants pliers that cut easily, grip hard, and last for years—and from experience he knows that Kraeuter pliers are THAT KIND.

Every pair is drop-forged from special plier steel; hardened and tempered with scientific accuracy; and adjusted with the precision of a dentist's forceps.

They "stand up" long after ordinary pliers are rusting on the junk pile.

YOU may not climb poles, but you DO need Kraeuter pliers—nearly *everyone* does.

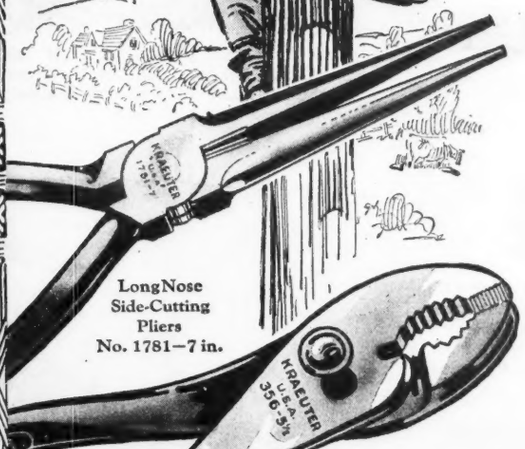
Perhaps you like to "make things," or invent, or experiment. Or maybe you are one of the "handy men" who do odd jobs around the house.

In any case, the best pliers are none too good for *you*.

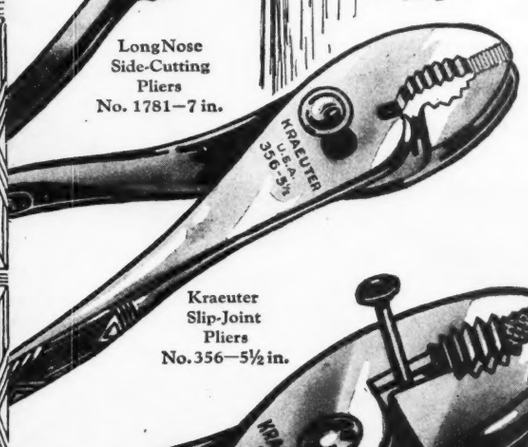
On Sale Wherever Good Tools Are Sold

KRAEUTER PLIERS

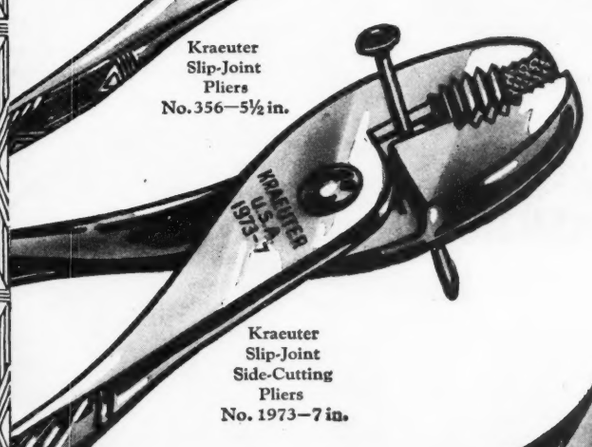
"Ask any Mechanic"



Long Nose Side-Cutting Pliers No. 1781—7 in.



Kraeuter Slip-Joint Pliers No. 356—5½ in.



Kraeuter Slip-Joint Side-Cutting Pliers No. 1973—7 in.

Dreadnaught Lineman's Pliers No. 2801—8½ in.

KRAEUTER PLIERS & TOOLS

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Low leakage at high frequencies

"WHAT is your opinion of Radion Panels?" was the question asked a number of winners in recent set-building contests.

The answer of one enthusiast was typical, "*The best!*" And he added, "I used it because of its low leakage at high frequencies."

Made to order especially for radio purposes, Radion Panels are noted for their low surface leakage and low dielectric absorption. And low losses in your set mean clearer reception, more volume and more distance.

Easy to cut, saw or drill

RADION Panels are easy to cut, drill or saw. They are strong, moisture-proof and resist warping. Eighteen stock sizes and two kinds, black and mahoganite.

Radio dealers have the exact size you want. The use of Radion Panels by the manufacturer of a ready-built set is almost invariably a sign of general good quality in that set.

Send for booklet, "Building Your Own Set"

OUR new booklet, "Building Your Own Set," gives wiring diagrams, front and rear views, shows new set with slanting panel, lists of parts and directions for building the most popular circuits. Mailed for 10 cents. Send the coupon now.

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Chicago Office: Conway Building
Pacific Coast Agent: Goodyear Rubber Company, San Francisco, Portland

RADION
(S) *The Supreme Insulation*
PANELS
Dials, Sockets, Binding Post Panels, etc.

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Dept. F5, 11 Mercer Street, New York City

Please send me your new booklet, "Building Your Own Set," for which I enclose 10 cents (stamps or coin).

Name.....

Address.....

The Home Workshop

How to Glue Boards Together

The Simplest Method of Preparing Table Tops and Other Wide Pieces

By **Emanuel E. Ericson,** *Noted Manual-Training Authority*

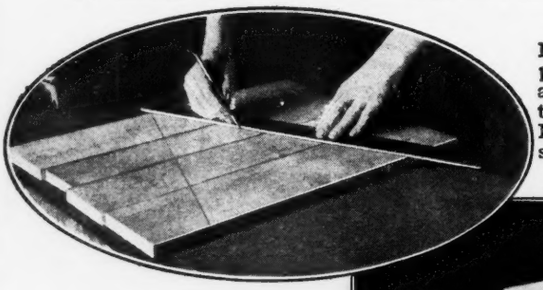


Fig. 1 (left)—Arrange the pieces with reference to color and grain. Put the wider pieces toward the edges, if possible. Mark two lines across in V shape and number the boards

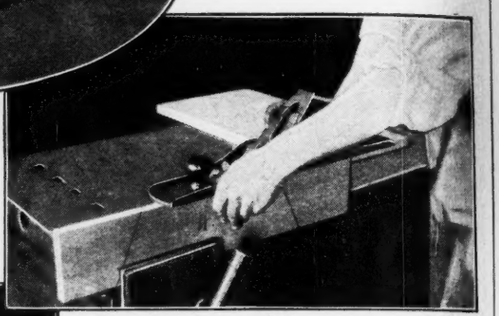
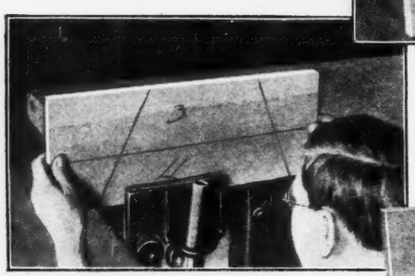


Fig. 2 (right)—The inside edge of the first board at either side is planed straight and free of "wind." No squaring is needed as the facing edge is to be planed to the corresponding angle. Have plane sharp



Note how the jointer plane is held parallel to the edge and how the fingers of the left hand help to keep it steady

Fig. 3 (above)—When the edge of the next board has been planed, the joint is sighted. At the ends the joint must be absolutely tight and true; the middle may be slightly open

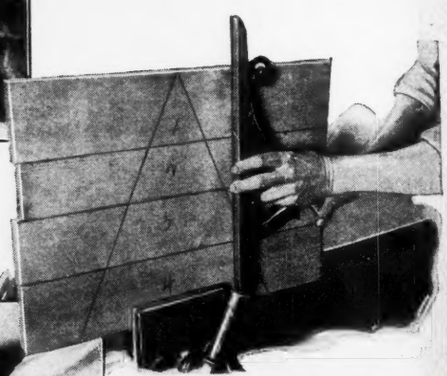


Fig. 4 (above)—When each joint has been planed, the whole piece is set up and tested for straightness

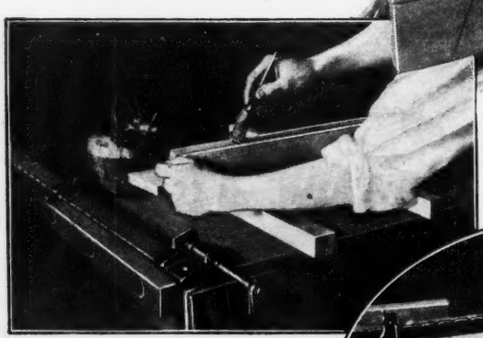


Fig. 5 (above)—Two pieces are laid across the bench to support the work. Clamps are adjusted for length before glue is applied. If the shop is cold, the joints should be warmed, but not made hot. Use freshly made glue of the best quality. If flake cabinet glue is used, it should be soaked beforehand in cold water. A good grade of liquid glue will serve, but warm the tin in water. Do not clamp too tightly. Level the joints on the face side with a mallet, or a block and a hammer

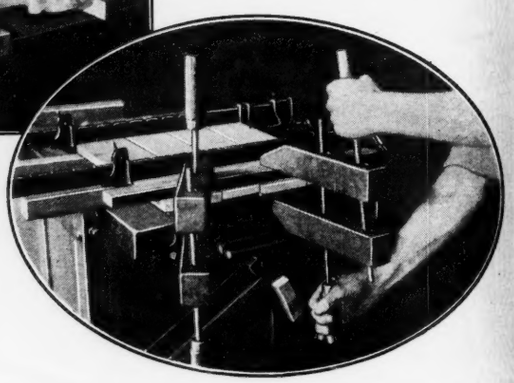


Fig. 6—The glued-up boards are kept straight by the use of wooden cross pieces and hand screws. These are put on each end of the work. The work is left for about 24 hours so that they will dry thoroughly

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Temper Savers!

Home repairs are easy—and *comfortable*—with a set of Blackhawk "Q. D's." There's a sturdy socket to hug each bolt and nut closely. And a handle that's really handy.

A small set of Blackhawk "Q. D's" is equivalent to a peck of fixed-socket or open-end wrenches.

Blackhawk engineers have designed a selected "Q. D." set for your particular car. It will quickly pay for itself in the time it saves.

Every Blackhawk socket is broached to exactly 1/64" oversize. The handles are just right for leverage, balance and strength. They all have firm, comfortable grips. Durable, all-black, baked-on finish.

Have your dealer show you how a small, inexpensive set of Blackhawk "Q. D's" is both temper-saver and money-saver. Write us direct if he can't supply you.

Made and Guaranteed by

AMERICAN GRINDER MFG. CO.

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Also manufacturers of Blackhawk Water Pump for Fords.

When You See a "Hex" Think of Blackhawk!

BLACKHAWK

Welded Wrenches

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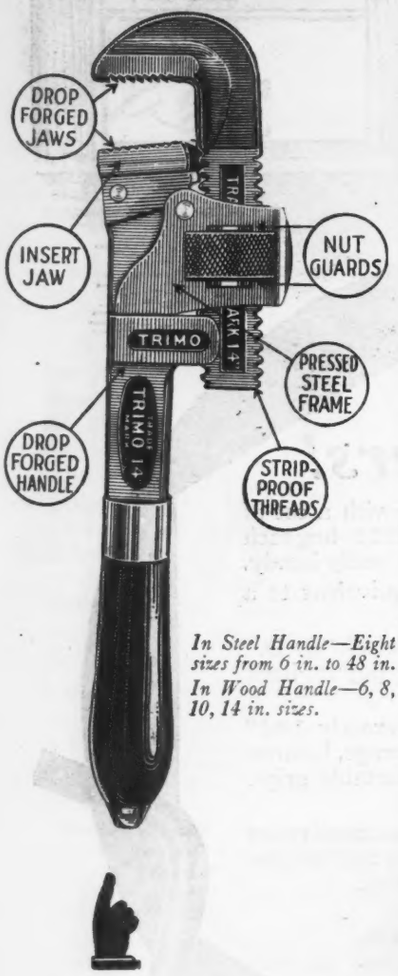
TRIMO



In Steel Handle—Eight sizes from 6 in. to 48 in. In Wood Handle—6, 8, 10, 14 in. sizes.

Examine this feature-illustration of the TRIMO Pipe Wrench carefully—think what each of these features means to you in time, money and labor saving—inspect and handle the TRIMO at your nearest dealer's—then you will clearly understand why the majority of America's skilled mechanics prefer this wonderful tool even though they can buy other wrenches at a few cents less. You can buy the TRIMO at most hardware, plumbing and mill-supply stores.

TRIMONT MFG. CO.
ROXBURY, MASS.

America's Leading Wrench Makers for Nearly 40 Years

The Home Workshop

What Was the Most Profitable Home Workshop Job You Ever Undertook?

New contest offers $50 in prizes for the best money-making and money-saving experiences of readers

WHILE the fun they get from working with tools is what leads most men to become home workshop enthusiasts, there is no disguising the fact that a vast amount of money is saved and earned each year in the home workshops of the United States.

Every job undertaken in your home workshop has a monetary value. You either repair some article and thereby prolong its life, or you make it unnecessary to purchase an equivalent commercial product, or you build something that is sold at a profit.

POPULAR SCIENCE MONTHLY wishes to bring together some of the most profitable undertakings of amateur mechanics.

For the best letter from a reader on the topic, "My Most Profitable Home Workshop Job," a first prize of $25 will be given. For the second best letter there will be a prize of $10, and for the third, a prize of $5. For the *ten* next best letters prizes of $1 each will be given.

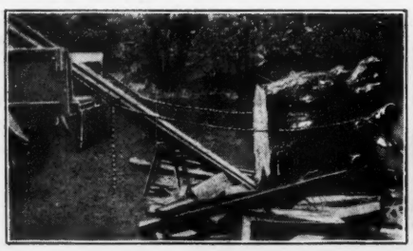
Contributions that do not win prizes, but are of sufficient general interest to warrant publication, will be purchased at regular rates.

No letter should be more than 400 words long. The money-saving or money-earning element must be stressed. In addition to telling what the job was, explain just why you consider it the most valuable of your home workshop undertakings. Give the exact value in dollars and cents if you can; otherwise estimate it as accurately as possible. It will add interest to your letter if you include a photograph or drawing showing the article or repair described, but this is not essential.

The contest will close May 25, 1925. All letters must be received on or before that date. The Board of Editors of POPULAR SCIENCE MONTHLY will act as judges and their decision will be final. Unavailable letters and photographs will be sent back only when accompanied by postage for their return. The winners will be announced as soon as possible after the judges complete their task.

Address your letter to the Profitable Job Contest Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Ave., New York.

Novel Method of Loading a Truck



WHEN heavy objects must be lifted on a truck without the aid of winch or tackle, it often is possible to use the method illustrated in the accompanying photographs. These show how a heavy stump was loaded by three men.

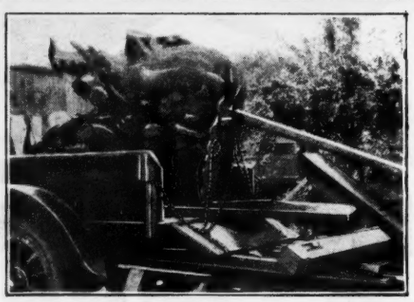


Fig. 1 (at left, above)—The first step. Fig. 2 (at right, above)—Halfway up. Fig. 3 (center)—Ready to back the truck under stump

The truck was backed toward the log and two 2-in. planks were leaned against the bed end (Fig. 1), with their lower ends under the stump. A chain was passed under an upper root snag and the ends made fast to the truck.

Upon being driven forward, the truck rolled the stump on the planks, where it was blocked by means of a pry (Fig. 2). The chain was tightened and the stump rolled up the incline once more, when it was possible to pry up the lower ends of the planks until they were nearly level with the truck bed.

Rollers were slipped under the front ends of the planks, the chain was tightened, and a third plank was braced against the stump as in Fig. 3. A cleat nailed to the stump above the brace prevented it from slipping. The truck was easily backed under the stump and its skids.

To unload the stump it was necessary only to pry against the skids, as the rollers were under the weight.—EDWIN M. LOVE.

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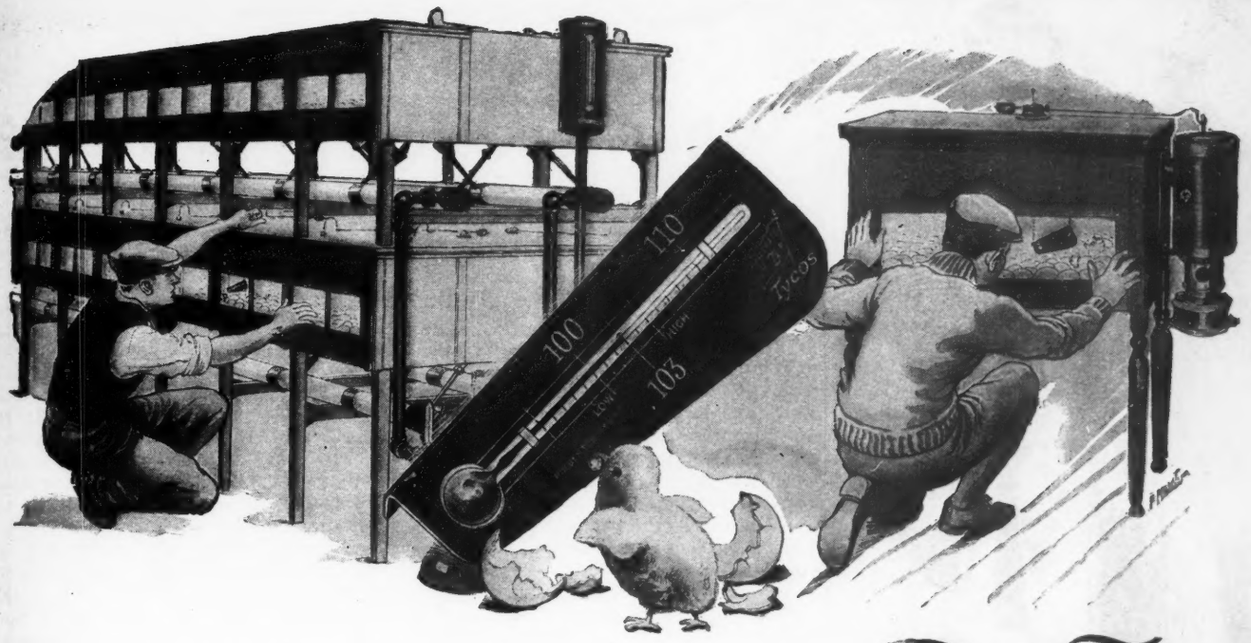

RAISING CHICKENS BY THE CARLOAD

ON THE GREAT FARMS where chickens are raised by the hundreds of thousands to ship to market, taking chances with the temperature of the incubators means the possible loss of thousands of eggs.

Only by keeping the incubators at 103 degree F. can the raisers of chickens on a wholesale basis be sure of hatching their eggs. The *Tycos* Incubator Thermometers register incubator temperatures accurately—always.

The same care is taken in making *Tycos* Incubator Thermometers as in making all the other Indicating, Recording and Controlling Instruments in the *Tycos* Line—the Sixth Sense of Industry.

Whether you raise chickens for market or family use, you need *Tycos* Thermometers in your incubator.

If you use heat processes in your manufacturing—whether hatching eggs or making steel, paints, furniture, rubber goods, metal ware, food products, or any other product that goes through heat-treating processes—you need in your plant the Sixth Sense of Industry—*Tycos* Instruments for Indicating, Recording and Controlling Temperature.

MANUFACTURERS

Tycos Engineers have effected substantial economy for manufacturers in every line of industry by applying the *Tycos* "sixth sense." Whatever *your* problem in the indicating, recording or controlling of heat, there is a *Tycos* Instrument to serve you. Write us for literature on any instrument, or type of instrument, and it will be sent promptly. Or, if you prefer, our engineers will consult with you on the application of the *Tycos* Sixth Sense in *your* plant.

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Tycos—for the Home

***Tycos** Wall Thermometers*
To help you maintain a temperature in your house conductive to good health.

***Tycos** Office Thermometers*
An aid in promoting human efficiency.

***Tycos** Bath Thermometers*
To enable you to get the most good from your bath.

***Taylor** Home Set*
Bake Oven Thermometer, Candy Thermometer, Sugar Meter. The secret of accurate results in cooking.

***Tycos** Fever Thermometers*
A necessity in every home.

***Taylor** Quality Compasses*
To show you the right way in unfamiliar country.

***Tycos** Stormoguide*
Forecasts the weather twenty-four hours ahead with dependable accuracy.

***Tycos** Hygrometer*
To enable you to keep the humidity of the atmosphere in your home correct at all times.

Your dealer will show them to you. Ask us, on a postal, for booklets on any of the above.

Tycos—for the Medical Profession

***Tycos** Sphygmomanometer, Pocket and Office types.*
***Tycos** Urinalysis Glassware.*
***Tycos** Fever Thermometers.*
Bulletins on request.

THE SIXTH SENSE OF INDUSTRY
Tycos Temperature Instruments
INDICATING • RECORDING • CONTROLLING

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A Necessary "Tool" For Your Workshop

FOR the man or boy who has a home workshop, Lee Union-Alls are a handy "tool" to have about. All that is necessary when you want to get busy is to slip into them and start your work. They cover the body from head to foot and can be worn over other clothing. They save clothes, also. And they save time where the hours for such work are limited.

Wear Lee Union-Alls, the *original* one-piece work suit, worn by thousands of mechanics, shopmen, garage workers and industrial workers. Lee Union-Alls are quality-built—close-woven cotton fabric, riveted rustproof buttons, reinforced strain points—fully guaranteed to give satisfaction. They give solid comfort, long wear, and are neat in appearance. Accept no substitute—look for Lee on the buttons. Thousands of live dealers sell Lee Union-Alls. Ask your dealer today!

Lee Union-Alls

THE H. D. LEE MERCANTILE CO.

Kansas City, Mo.

Trenton, N. J. Minneapolis, Minn. South Bend, Ind. San Francisco, Cal

Lee Overalls and Work Shirts are other items in the famous Lee line. They are quality-built, also.

The Home Workshop

"What Makes My Ford Creep?"

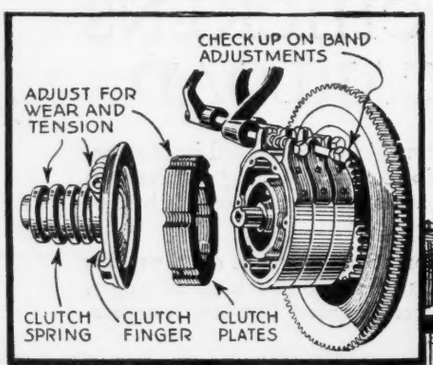
The causes for a familiar trouble and how to remedy it

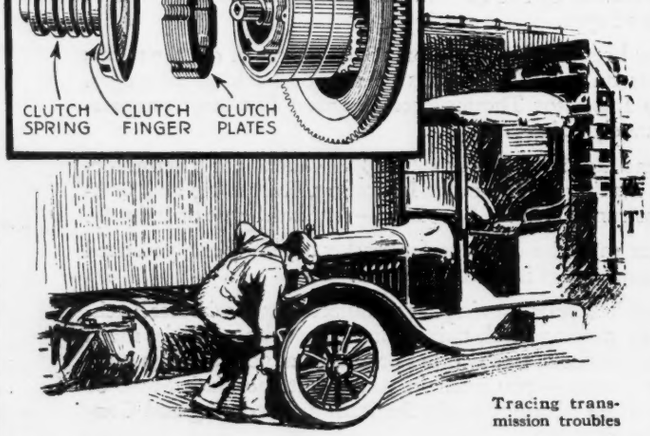
By Ray F. Kuns

Author of "Automotive Trade Training"

"WHAT makes my Ford creep on me when I try to crank it?" is a question frequently asked. With the larger use of electric starters, less attention is paid to this trouble than formerly, yet the results are no less serious. The tendency of a Ford car to creep forward when cranked by hand wears out the operator; the same tendency in an electrically equipped car puts the electrical equipment to a severe test and wears out the battery.

The matter of a creeping car is not so simple as might at first appear. There may be a number of contributing causes. In cold weather the trouble may seem to grow worse, until some morning either the operator or battery is completely exhausted in an attempt to start the engine. The engine turns as though there were some tremendous power holding it back and the car may show a tendency to creep forward. The trouble very likely is due to the condition of the oil within the engine and especially the oil in the clutch and under the transmission bands.





Tracing transmission troubles

Not only must the oil be light in body, but it must remain that way at any low temperature that may be reached and it must retain its lubricating qualities, no matter how hot the engine may become. It is a fact, too, that Ford engines are "boiled" about as often in the winter as in the summer.

Another trick used by experienced drivers is to allow the clutch to be engaged when stopping the car in the garage at night, or elsewhere. They claim that this squeezes all the oil out of the clutch plates while it is warm. In the morning when the clutch-and-brake lever is set on neutral, the clutch plates separate, and, as the oil has been squeezed from between the plates, the clutch will not drag.

Every driver, of course, is familiar with the fact that if the bands are drawn too tight, the engine is hard to crank. He also knows that the engaging of slow speed in the Ford car is merely a result of gripping or holding the slow-speed drum. Consequently when the oil under the slow-speed drum is thick and gummy, it has the same effect as gripping or holding the slow-speed drum and thus tending to propel the car forward. For this reason it is well to check up carefully on the adjustment and not allow the bands to be set too closely.

Another cause of creeping in a Ford car, and one not so easily remedied, is the wear that occurs in the transmission parts, particularly in the clutch. The Ford clutch plates are steel. One group of these is mounted on the clutch disk drum and the other group is mounted in the brake drum. When the clutch lever is in neutral, the plates are separated; and when the lever is in forward position, the disks are together and held so by the tension of the clutch spring. The tension on the clutch fingers may be adjusted and thus offset some of the tendency of the clutch plates to drag. On the other hand, if they are allowed to be too loose, the clutch will not hold and there will be a loss of power in high gear.

IN A new car there is no difficulty in adjusting the clutch fingers properly. In an older car they will have to be set up until the clutch holds. In this instance there may not be much of a throw-out and instead of the clutch plates releasing as they ought, they may hold because little grooves or notches have been worn in the brake drum or in the clutch-disk drum by the hard lugs on the clutch plates.

As long as these plates or part of them remain with their lugs in these notches

(Continued on page 94)

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 21.

EVEREADY HOUR
EVERY TUESDAY AT 9 P.M.
(Eastern Standard Time)
For real radio enjoyment tune in the "Eveready Group." Broadcast through stations—

WEAF	New York	WFI	Philadelphia
WJAR	Providence	WCAE	Pittsburgh
WEEI	Boston	WGR	Buffalo
WEAR	Cleveland	WOC	Davenport
WWJ	Detroit	WCCO	Minneapolis, St. Paul

The proven Dry Cell for all Radio Dry Cell Tubes

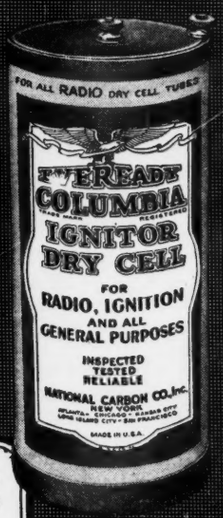
Recommend good batteries

IN AN effort to reduce the first cost of a radio set, a newcomer in radio often buys inferior batteries. *You* know such "saving" is really wasteful. Tell your friends who are about to buy receivers that the best batteries obtainable will prove to be the most economical. Tell them to buy Eveready Radio Batteries—they last longer and, because they are greatly superior, they give complete satisfaction.

There is an Eveready Radio Battery for every radio use.

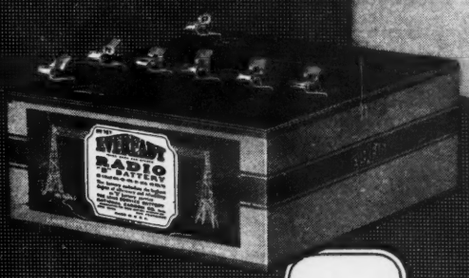
Manufactured and guaranteed by
NATIONAL CARBON COMPANY, INC.
New York San Francisco
Canadian National Carbon Co., Limited, Toronto, Ontario

EVEREADY
Radio Batteries
—they last longer



Eveready Columbia Ignitor Dry Cell "A" Battery for all Dry Cell Tubes 1½ volts

No. 770 45-volt Extra Large Vertical Price $4.75 For use on multi-tube sets



No. 767 45-volt Large Horizontal Price $3.75 With variable taps

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WORTH WHILE TOOLS

Here's the indispensable tool for the mechanic in shop or garage and for the handy-man-around-the-home. The tool needed almost daily for the odd jobs that crop up. There are a hundred things about the home or shop to get out of order at a moment's notice, which can be adjusted just as quickly if there's a Wrench at hand.

Pexto Adjustable Angle Wrench takes the place of several solid end wrenches. They are backed by a century of tool making experience and are a combination of skillful workmanship and materials of quality. They can be furnished in sizes 4 inch to 12 inch, in full polish or semi-polish finish. They are drop forged steel, properly hardened and in every respect worthwhile tools.

Other tools in the Pexto line are Braces, Bits, Hammers, Chisels, Squares, Hatchets, Pliers, Snips, Screw Drivers and many other small tools. Ask your dealer to show you Pexto tools.

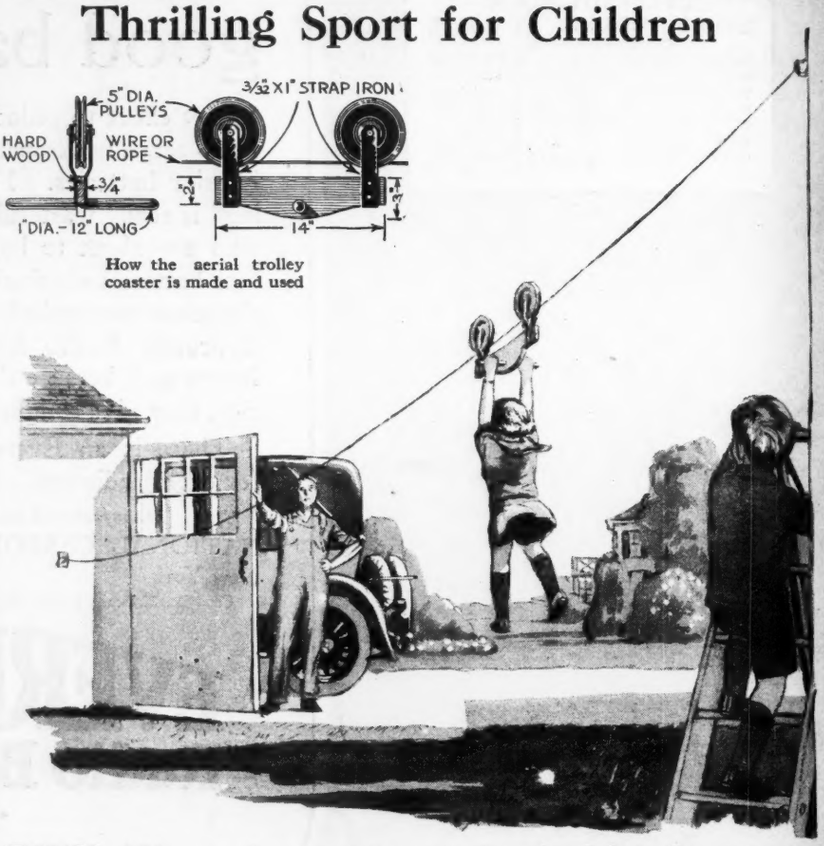
Ⓢ

The Peck, Stow & Wilcox Co.
Southington, Conn., U. S. A.

The Home Workshop

Backyard Aerial Coaster Provides Thrilling Sport for Children

How the aerial trolley coaster is made and used



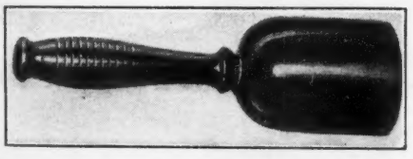
SMALL children can have great fun in riding on the aerial trolley coaster illustrated above. It not only is thrilling sport for the youngsters, but also develops their hand and arm muscles.

The coaster is made from two pulley wheels, such as are used for clotheslines, about 5 in. in diameter. These are mounted with strap iron or in any suitable way to a wooden carriage cut from a ⅞ by 3 by 14 in. board. A length of 1-in. dowel or a portion of a broomstick is run through a hole in the center of the carriage to form the hand grips.

The trolley is mounted on a wire or rope clothesline stretched across the yard at an easy angle.

The children climb on a stepladder, porch, or stand of some kind and, grasping the handle-bars, slide down the incline until their feet touch the ground at the other end of the line. The carriage is pulled back with a rope or pushed with a stick.—DONALD W. CLARK.

Woodworker's Mallet Turned from Piece of Hard Wood



IF YOU have access to a wood-turning lathe, it is a simple matter to make yourself a neat and useful mallet.

Instead of making the head and handle separately, as is usually the practice, you will find it easier to turn the tool from a single piece of close-grained, hard wood, preferably hickory or maple.

The mallet is 8¾ in. long in its entire length, the head being 2¾ in. in diameter and 3½ in. long, and the handle 1⅛ in. in diameter at its thickest part and 5¼ in. long.

"What Makes My Ford Creep?"

(*Continued from page 92*)

they will not release fully, but will present quite a resistance or drag. This again has a tendency to cause the car to creep forward when the engine is cranked.

This is a job for the repairman. The engine must be removed from the car and dismantled, at least to a point where the transmission may be torn down and rebuilt. This work may be done by releasing all the engine crankcase bolts and removing the transmission cover, after which the cylinder block and transmission may be lifted from the car, leaving the crankcase pan in the car. The better plan, however, is to remove the engine or power plant as a unit and thus make all parts more readily accessible and insure a better grade of work. Extreme care must be used by the beginner in disassembling and assembling the transmission.

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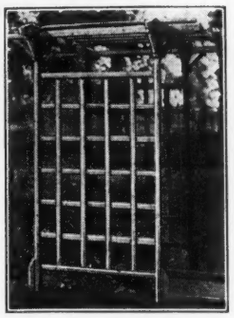
The Home Workshop

Trellis for Climbing Roses Costs $4 for Materials



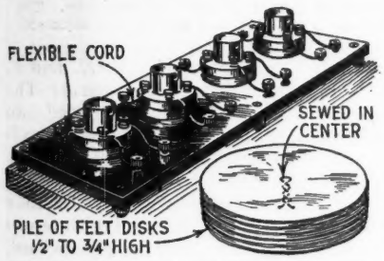
MY CLIMBING roses were not doing very well against the house, and I decided to build a trellis for them. By modifying and combining designs published in POPULAR SCIENCE MONTHLY, I constructed the trellis illustrated at a total cost of only $4. It is made of cedar, using 2 by 2 in. pieces for the uprights and 2 by 4 in. pieces for the cross bars on top. The lattice strips are ¼ by 2 in. The wood is stained brown.—H. C.

Felt Disks Serve as Cushions for Vacuum-Tube Sockets

HOW tube sockets may be mounted so as to eliminate noises caused by vibration, which are especially noticeable in the "hard" tubes now almost universally used, is illustrated below.

Each socket is mounted on a cushion made of pieces of felt sewed together and cemented to the socket.

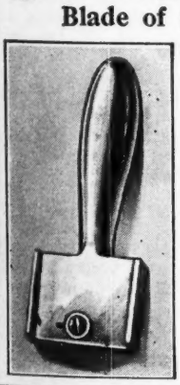
As many sockets as are needed may be mounted by this method on a composition



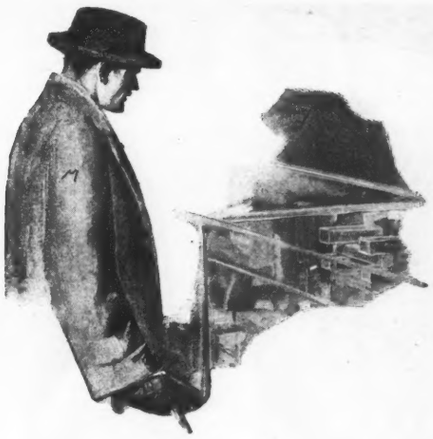
How the pads are made and method of mounting several jarproof tubes on a single base

or hard rubber strip about 3½ in. wide and ⅛ or 3/16 in. thick. The strip is fastened to the base of the set with wood screws, which pass through spacers to hold the heads of the binding-post screws off the baseboard. Round nuts from old dry cells may be used for this purpose.—DONALD H. PALMETER.

Special Holder for Sharpening Blade of Spokeshave



TO OVERCOME the difficulty of holding a spokeshave blade when grinding it or whetting it on an oilstone, I made the holder illustrated. It may be either hard wood or metal. I found one made of cast iron to work better because it is heavier. The handle is about 4 in. long.



Wait—*Don't Buy*

Find out first that our claims are true. Make this 10-shave test.

DEAR SIR:

You're a fair minded man—and as such will give other men a chance to prove any sincere claims they advance.

Now the ones we make for Palmolive Shaving Cream are pretty broad. You may question them.

So we say, "Don't buy yet"—Let us send you a 10-day tube to try. And thus, grant us the opportunity of proving how true those claims are.

Men by the millions have shifted to this unique cream. Today it occupies pinnacle place in its field; its success is a trade sensation. 80% of its users were wedded to rival makes. Only outstanding merit, you'll agree, could shift so hard a market.

Find Out, Please

So we ask you, now, in fairness to us both, please mail the coupon. We'll rest our case on what you find. After 10 days of new shaving delight, few men go back to old ways.

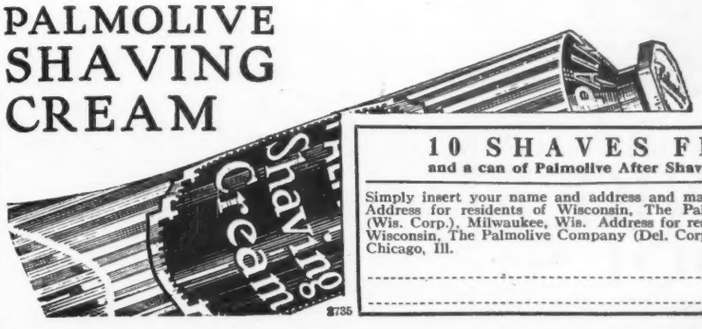
5 Delights
Five remarkable results:

1 Multiplies itself in lather 250 times.
2 Softens the beard in one minute.
3 Maintains its creamy fullness 10 minutes on the face.
4 Strong bubbles hold the hairs erect for cutting.
5 Fine after-effects, due to palm and olive oil content.

To add the final touch to shaving luxury, we have created Palmolive After Shaving Talc—especially for men. Doesn't show. Leaves the skin smooth and fresh, and gives that well-groomed look. Try the sample we are sending free with the tube of Shaving Cream. There are new delights here for every man who shaves. Please let us prove them to you. Clip coupon now.

THE PALMOLIVE COMPANY (Del. Corp.), Chicago, Ill.

PALMOLIVE SHAVING CREAM



10 SHAVES FREE
and a can of Palmolive After Shaving Talc

Simply insert your name and address and mail to Dept. B-984. Address for residents of Wisconsin, The Palmolive Company (Wis. Corp.), Milwaukee, Wis. Address for residents other than Wisconsin, The Palmolive Company (Del. Corp.), 3702 Iron St., Chicago, Ill.

2735

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He's drilling out a broken rivet on a steering column with a "Yankee" Ratchet Hand Drill. Thanks to the "Yankee" DOUBLE Rachet he can work in the easiest position, as only a slight to and fro movement of crank is needed to make the drill cut continuously.

In places where ordinary drills won't work, the "Yankee" Hand Drill No. 1530 quickly drills clean, accurate holes. No need to tear down construction.

When set at DOUBLE Ratchet, the slightest movement of crank makes drill cut continuously.

"YANKEE" Rachet Hand Drill No. 1530

Though a midget in size, it has every ratchet adjustment of the big "Yankee" Breast Drills and Hand Drills. Five in all—Plain Drill, Left-hand Ratchet, Right-hand Rachet, DOUBLE Ratchet and Gears Locked. Weighs only 1¼ lbs. Measures only 10½ in. long.

Some other "Yankee" Tools
Ratchet Breast Drills
Ratchet Tap Wrenches
Ratchet Screw-drivers
Spiral Screw-drivers
Automatic Push Drills
Dealers Everywhere sell "Yankee" Tools

May we send you this FREE Tool Book?

You'll be interested, we know, in seeing all the "Yankee" time and labor-saving tools. Write for it today!

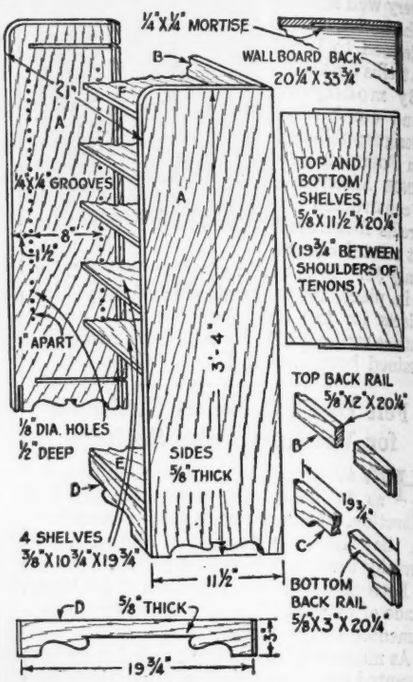
NORTH BROS. MFG. CO., Philadelphia, U.S.A.

"YANKEE" TOOLS

Make Better Mechanics

The Home Workshop

Attractive Case Holds Magazines and Books

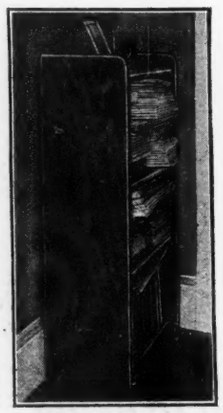


Working details of the hardwood case. The distances between the shelves are adjustable

IF CAREFULLY constructed, the magazine case illustrated may be placed alongside commercial furniture of good quality. Its use is not confined necessarily to books; it will serve for other purposes.

The case is constructed from ¾-in. stock dressed to ⅝ in. thick throughout, with the exception of the back and middle shelves. Preferably mahogany, curly whitewood or some good cabinet wood should be used.

Each of the sides *A* is cut to the dimensions indicated, with mortises ¼ in. wide and ¼ in. deep, and 2 rows of holes ⅛ in. in diameter and ½ in. deep. The holes are for short lengths of nails, which are used to support the shelves. This method allows the height between the shelves to be changed.



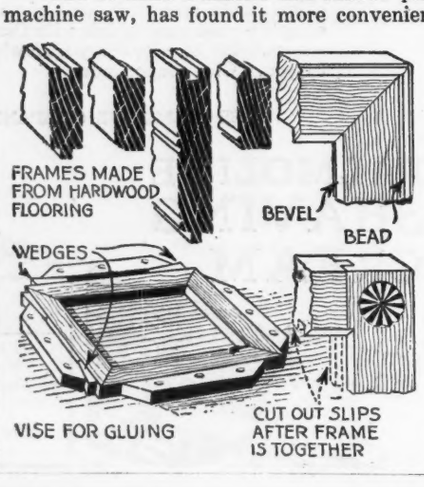
How the finished case looks in use

The top and bottom shelves, *E* and *F*, are tenoned and fit in mortises in *A*. The pieces *B*, *C*, and *D* also are tenoned into side pieces. The back is a sheet of wallboard fastened in a groove running the entire length of the side pieces.

The parts may be assembled with a good grade of liquid glue and with screws wherever needed. After the glue is hard, the case should be cleaned up with fine sandpaper. Care should be taken that the edges are not rounded, but kept square. Finish the case as preferred.

Cheaply Made Frames

ON MANY occasions the writer, even when he had at hand a fillister and rabbet plane, or a machine saw, has found it more convenient to use odd pieces of tongue-and-grooved stock to make frames for pictures, mirrors, small panels, and other purposes. The tongue may be taken off with a slight effort with chisel and plane; the inner



An efficient clamp for holding picture-frames together while the joints are glued

(*Continued on page 97*)

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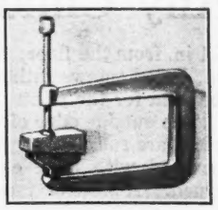
The Home Workshop

Extra Jaw Adapts C-Clamp for Holding Tapered Pieces



WHEN it is necessary, as often happens, to hold a tapering or irregular piece in a C-clamp, the attachment illustrated is convenient. It is a small jaw made of any soft steel. The surface is roughened to prevent slipping when used on steep tapers. At the back is a tongue, semicircular in section, which fits into a V slot filed in the fixed jaw of the clamp. The supplementary jaw is free to adjust itself automatically to the work.

Cheaply Made Frames

(*Continued from page 96*)

slip or lip of the groove likewise may be removed. The material then is ready to be mitered.

This method is particularly applicable at the present time when severely plain hardwood frames are the vogue. At picture exhibitions in New York recently there have been a surprising number of these frames, finished in natural color as thinly and unobtrusively as possible.

Plain or quartered oak, maple or other flooring may be used, as it is always very well machined and perfectly smooth. Nearly every carpenter has odd, left-over pieces of both flooring and tongue-and-groove wainscoting, some of fine cabinet hard woods. These are suitable for this purpose and may be obtained cheaply.

The drawings on page 96 show plainly how the material is prepared. It may be left quite plain with only the tongue removed, or given a bevel on the inside edge, or a rounded outer edge or, if preferred, an ornamental bead. If one has molding tools, other designs may be formed from the same material.

Many excellent suggestions have appeared in POPULAR SCIENCE MONTHLY in regard to joining the frames—methods making use of a special small wooden vise, a machinist's vise, a piece of string tied around with small blocks used to tighten it, and others. These are all good. I add one other, which I find has the advantage that the work can be tested readily to see that the joints come together before gluing. That is important, especially in frames from 2 to 4 in. wide.

Nail on the two cleats at right angles to each other and quite square inside as shown. The other two cleats are cut to suit the wedges. Allow room for nailing at the two most convenient corners. Place a small piece of tough paper under each corner when gluing, also touch with glue about ½ in. of the under side at the joints so that the paper will stick.

When the glue is hard, drill holes for the brads and see that the wedges are tight and the frame firm before using the hammer. Having nailed two corners, reverse the frame for the others.

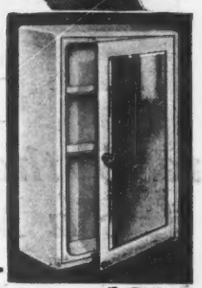
In another detail I show a square joint with short tenons.—A. E. ELLING.

SAVE HALF - INSTALL YOUR OWN
PLUMBING AND HEATING
BY OUR *New Easy Method*

CHICAGO HIGH GRADE BATH-ROOM OUTFIT $59.95

Complete Bathroom Outfit, built along practical and attractive lines. Highest grade possible to make. Shows that First Quality Hardin-Lavin products can be had at low cost.

WHITE ENAMELED BATH TUB Cast Iron, heavy white porcelain, enameled inside and over the 3¼ inch turned-over rolled rim; outside painted. Newest Design. Fitted complete with heavy brass, nickel-plated compression bath faucet, with china indexed handles, nickel-plated heavy brass adjustable waste and overflow and supply pipes to floor; width 30¼ in., length 4½ or 5 ft., weight 300 lbs.
Chicago A-50—Bathtub complete as shown with iron-pipe connections. Special **$31.10**



White Closet Outfit
Improved, snow-white composition China Closet tank (beautiful and indestructible); fitted with solid brass elevated noiseless valves and improved china flushing handle. Highest grade white vitreous China syphon washdown bowl. Highly polished, reinforced birch mahogany seat, with heavy brass, nickel-plated bar hinges, flushing oil, supply pipe, closet bolts, etc., weight 125 lbs.
Chicago A-52—White Closet Outfit, complete as shown with iron-pipe connections. Special..... **$19.95**

Medicine Cabinet, Special..... $8.95
Highest Grade White Enameled Steel; all joints electrically welded before enameled with four coats of baked enamel, inside and out. Has plate glass beveled mirror, two plate glass shelves, heavy glass knob and enameled non-sag hinges. Cabinet is guaranteed to be entirely satisfactory and carefully crated to reach you in first class condition. Hang on any wall with two screws. Height 21 in., width 16 in., depth 5 in., wt. 35 lbs.
No: 5137—White enameled Cabinet. Special, reduced to..... **$8.95**

ANY HANDY MAN can install his own Plumbing and Heating by our New Easy Method and Save Half. In the past 50 years, we have saved our customers hundreds of thousands of dollars in the cost of: Plumbing Goods, Pipeless and Warm Air Furnaces, Steam Boilers, Hot Water Boilers, Water Supply Systems, Water Heaters, Bathroom Outfits, Pipes, Radiators, Valves, Supplies, etc.

BIG HANDY MAN BOOK

Tells the whole story. Shows the Hardin-Lavin New Easy Method. Send coupon with 25c (regular price 50c, refunded on first order) for your copy today. This Big, Instructive, Well-Bound "Handy Man" Book-Catalog shows 10,000 items in latest style, highest quality Plumbing and Heating Fixtures and supplies at Wholesale Prices.

Hundreds of Trade Secrets

Also shows many valuable diagrams, plans and elevations of simple installing systems, trade secrets and money, time and labor saving kinks. Most valuable book of its kind published. SEND 25c FOR YOUR COPY TODAY.

Read Our Guarantee

Write this magazine or your bank about our 50 years' record of square dealing and about our new million dollar plants. ORDER TODAY AND SAVE. YOU CANNOT LOSE.

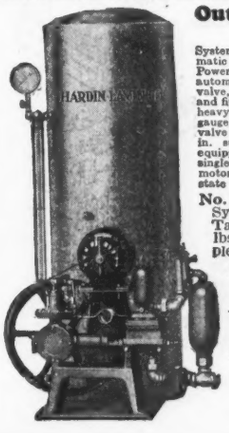
Bonded Guaranty
We guarantee that every article we sell from the smallest fitting to a complete installation is perfect and exactly as shown and of the HIGHEST GRADE that is possible to manufacture. We further guarantee that if you are dissatisfied for any reason, you can return any goods bought from us and we will immediately refund your money plus freight charges you have paid. (Signed)
HARDIN-LAVIN CO.
Could Anything Be Fairer?

Deep Apron Lavatory
Late design, white porcelain enameled, cast-iron drop apron lavatory, supported on concealed wall hangers; new low design, china indexed compression faucets, heavy brass, nickel-plated adjustable supply pipes and trap to floor or wall, size 17x19½ in., weight 120 lbs.
Chicago A-51—Lavatory. Complete as shown with iron-Pipe connections. Special..... **$11.75**
Chicago A-53—Bathroom outfit, complete as shown and described. Special..... **$59.95**
All shipped from Chicago plant same day as order is received. Order today. You cannot lose.

Super Improved Automatic Electric Water Supply System

Absolutely reliable, fool-proof and simple. Can be depended upon to give lasting service with practically no attention. No better outfit made for SHALLOW WELLS OR CISTERNS WHERE WATER IS NOT OVER 22 FEET BELOW SURFACE.
Complete $98.50

Noiseless Pump Runs in Oil
Noiseless, double acting, brass fitted throughout and fully enclosed and lubricated by the "New Splash System." All moving parts run in oil bath which insures long life. Latest type oversize 1-6 Horse Power electric motor, operates economically and is thoroughly reliable; surplus power to drive pump under all conditions.



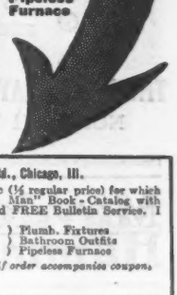
Outfits Complete—No Extras
System consists of pump with automatic air valve, oversize 1-6 Horse Power repulsion induction motor, automatic switch set at 40 lbs., relief valve, shut-off valves, necessary pipe and fittings as shown; one galvanized heavy pneumatic tank with pressure gauge, one ¾ in. galvanized foot valve and strainer. Pump has ¾ in. suction and discharge. Outfit equipped with 60 cycle, 110-220 volt, single-phase alternating current motor. If you have other current, state voltage, etc.

No. A.—500. Water Supply System with 42 Gallon Tank. Shipping Weight 300 lbs. Price, complete, Special **$98.50**

No. A.—501. Water Supply System with 80 Gallon Tank. Shipping Weight 340 lbs. Price, complete, Special **$110.50**

No. A—502. Water Supply System with 100 Gallon Tank. Shipping Weight 380 lbs. Price complete, Special **$122.50**

Heating Plants Cut-To-Fit
Hot Water—Steam—Hot Air—Pipeless
Hardin-Lavin Cut-To-Fit Hot Water Heating Plants give highest heat efficiency at lowest cost. Boiler embodies best engineering; easy dumping grates; long indirect fire travel that insures complete combustion and greatest heat. Our modern equipment and 50 years' practical experience qualifies us to produce this boiler that will burn any kind of fuel, cleanly, completely, and economically. WE HELP YOU PLAN. Every Hardin-Lavin Heating System is figured to eliminate long runs of piping, to save valuable time, and expensive labor. With our complete instructions and simple installing features, you can do the work yourself and save. We loan the tools if necessary. WRITE TODAY FOR LOW WHOLESALE PRICES.



Free Estimate
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Gentlemen: Enclosed please find 25c (¼ regular price) for which send me your Big Complete "Handy Man" Book-Catalog with special **Wholesale** discount sheets and **FREE** Bulletin Service. I am interested in:
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Note: "Handy Man" Book is FREE if order accompanies coupon.
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You can tell by the "Hang" It's a Maydole

Next time you're in the hardware store pick up a Maydole Hammer. Balance it in your hand. Swing it. It makes you itch to come down on a nail and drive it home.

No other hammer has just the Maydole 'hang'. It's the result of 82 years of accumulated skill and experience in making fine hammers.

The head is press-forged of selected steel, specially tempered. The handle is of clear, second-growth hickory, perfectly seasoned. Together they make a beautifully balanced hammer that's in a class by itself for service and wear.

Whatever style of hammer you want,—carpenters', machinists', or any other type—ask your hardware dealer to show you a Maydole. Once you've handled it you'll never be content with an ordinary hammer.

Write for our free pocket handbook 23 "B". It's interesting and useful.

THE DAVID MAYDOLE HAMMER CO.
NORWICH NEW YORK

Maydole Hammers
YOUR HAMMER SINCE 1843

7642

The Home Workshop

A Desk to Make Any Child Happy

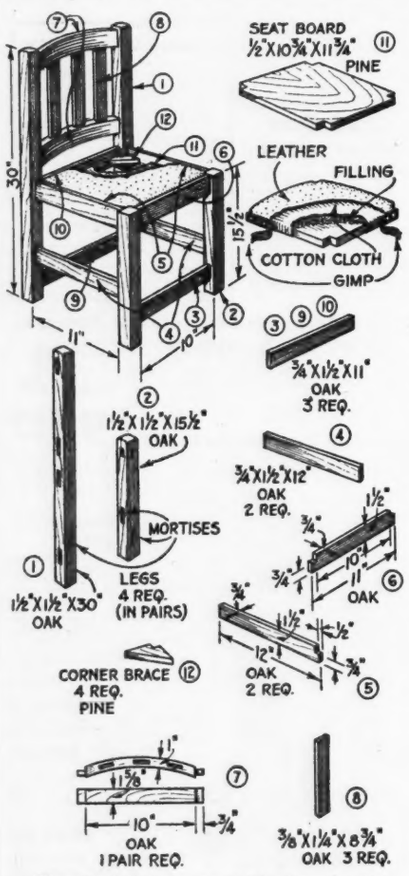
ALMOST any little girl or boy from eight to 10 years of age would like to have this desk and chair. They are of simple construction and may be made of any wood, but preferably of well-seasoned oak.

Each part can be laid out and cut to the dimensions indicated, or the sizes may be altered to suit the age of the child, if older than 10 years. The desk stands 24 in. from the floor; the chair seat, 15½ in. Wood screws rather than nails should be used for the joints.

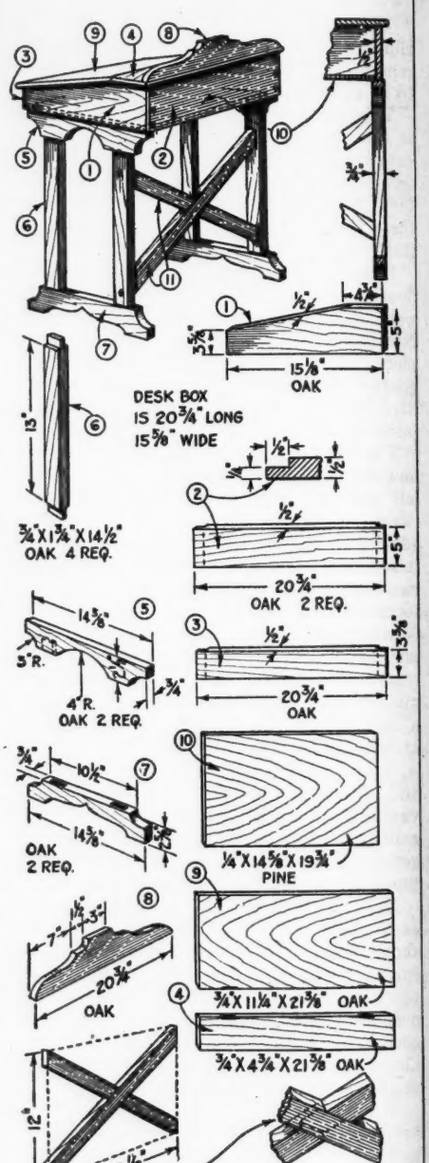
The outside edge of the cover and back piece are rounded slightly, and the top is covered with desk cloth, stretched and glued. A piece of auto-top covering, if in fairly good condition, makes an excellent cover. If preferred, the top may be left plain. The cover is joined to the back piece with two 1½-in. narrow brass butt hinges.

Scrape or sandpaper the wood as smoothly as possible. If a natural finish is desired, fill the wood with a paste filler and apply two or three coats of white

(*Continued on page 99*)



How the chair is constructed is shown by the numbered details in column directly above



In this column are the parts of the desk similarly numbered to show where they are used

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The Home Workshop

Fishing-Rod Shipping-Case Made from Rain-Pipe

IF YOU are in the habit of carrying your fishing-rods without any protection save thin canvas cases, sooner or later they will come to grief in transit.

A tube for two fishing-rods can be made readily out of a length of round galvanized iron rain-spout tubing about 3 in. longer than the rods when they are unjointed.

Fit and nail a round piece of wood into the lower end. Prepare another round piece to fit tightly into the top and provide a strap handle. Cut a piece of canvas to fit over the tube, sew it along the side, turn it with the seam in, and slip the tube into it. The top of the canvas can be hemmed for a drawstring. Sew a neat round patch on the bottom of the canvas casing.—ROBERT PAGE LINCOLN.

A Desk to Make Any Child Happy

(*Continued from page 98*)

shellac. Rub smooth and finish with several coats of furniture wax.

All the joints of the chair are tenoned and glued. Both top and bottom back ribs are alike and a templet can be made as a guide in working out the curves.

The seat board, which holds the padding in place, is fitted in after the frame is put together, but it need not be a tight fit. It rests on four angle pieces nailed into the corners on the under side.

In upholstering the seat, tack a piece of stout cotton cloth along one edge and about halfway on each side. The filling is pushed under with the hand or with a flat stick. Be sure to get the filling well into the corners. Pack it high and level in the center and slope it away on each side toward the edges. When the filling is all in, pull the remaining edges of the cloth tight and tack down all around.

The outer cover may be leather or imitation leather, cut to size and tacked at four corners with carpet tacks to hold it in place. A piece of upholsterer's tape or gimp is fastened around the edges with evenly spaced upholstery tacks.

Finish the chair to match the desk. Both the legs of the chair and the feet of the desk are fitted with polished steel glides. —H. L. WHEELER.

PORTER'S

TIME AND LABOR SAVING

PORTER'S BOLT CLIPPERS and Wire Cutters are hand tools, developing tremendous cutting power through a combination of leverages. Fifty pounds' pressure on the handles delivers approximately three thousands pounds' pressure at the cutting point.

The three types of cutters shown in this advertisement represent the particular models most generally used. A good, all-round size of tool is represented in Size 3 with a capacity of 5/8" annealed bolts in the thread. Other sizes have capacities ranging from 3/16" to 3/4" annealed bolts in the thread. Special nut-splitting tools are obtainable in both side and end-cutting models.

Side Cutter: A tool of all round service. Cutting jaws are parallel with the handles.

End Cutter: Cutting edge on this tool is at right angles to the handles. Every PORTER Cutter is built on exactly the same principles. Differences between the various models lie in the types of cutting jaws.

Angular Cutter: Jaws are set at 30° angle to handles. Gets into difficult places. Saves stooping.

H. K. PORTER, INC.
EVERETT, MASS.

Sold by retail hardware stores and carried in stock by leading hardware jobbers

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There *is* a difference in Hack Saw Blades

—long life
—fast cutting
—uniformity

That's where the difference in hack saw blades shows up. Blades made by Millers Falls Co. at their West Haven plant will answer your most exacting requirements.

Best quality tungsten steel—for long life. Milled teeth with special patented set—for fast cutting. Individually hardened—for uniformity.

Same high quality as other Millers Falls Tools. All hard and flexible, in standard gauges.

When you place your next order, insist on hack saw blades made by Millers Falls Company.

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Millers Falls, Mass.
28 Warren St. New York — 9 So. Clinton St. Chicago
Manufacturers of Mechanics' Tools, Hack Saws and Automobile Tools

MILLERS FALLS TOOLS
SINCE 1868

The Home Workshop

Simplified Model-Making

Third article in a series on miniature railroads

By Edward E. de Lancey

WHEN the trucks of your model electric locomotive or coach have progressed to the stage shown in Fig. 1, it is well to ascertain if all four wheels of each truck bear evenly on the rails. To do this, place the truck on a true and perfectly flat surface, such, for instance, as a piece of plate glass or marble. See if the weight rests evenly on all four flanges. If it "teeters" slightly, ease up a little on each of the eight corner screws until the truck comes true. Bring the second truck to the same degree of advancement, if you have not already done so.

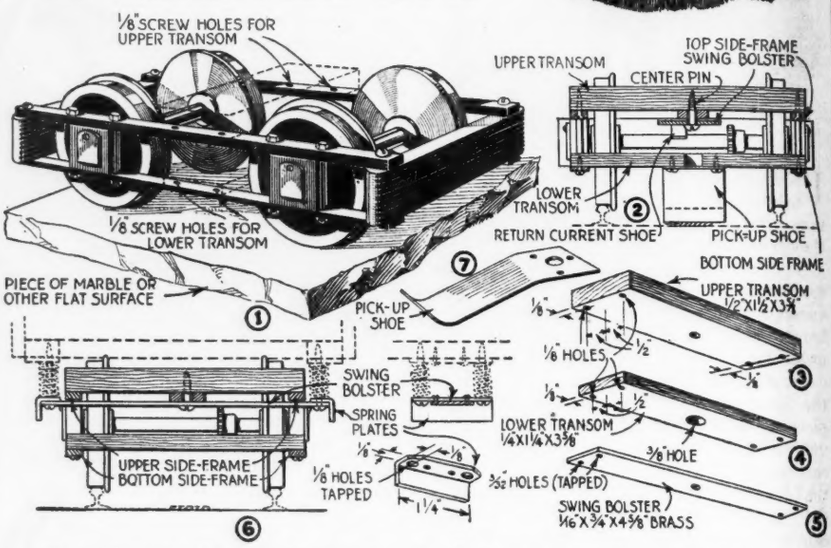


Fig. 1—Typical model railway truck made as described last month. Fig. 2—Transoms and swing bolster. Figs. 3, 4, and 5—Details. Fig. 6—Spring mounting. Fig. 7—Pick-up shoe

Beginning with the upper transom (Fig. 2), place all the markings on its under side. With a fine saw (a hacksaw will do), cut a piece from your stock of the required cross section and of a length equal to the distance between the outer edges of the side frames. Test the ends with a small square; then mark a cross line ⅛ in. from each end. Each of the cross lines should coincide with the median line of the side frame if your work has been carefully done.

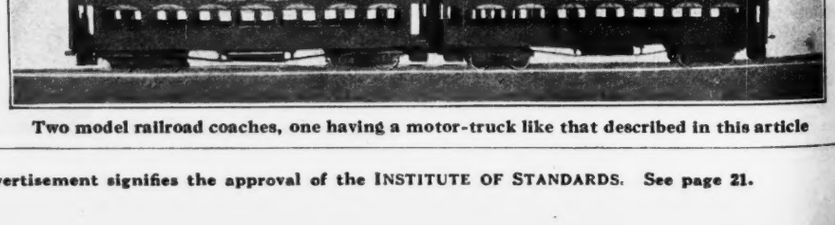
The center line of the transom now must be drawn carefully from end to end (Fig. 3). Then lay the transom in its proper position across the frames, hold it firmly, and with a soft pencil, mark the position of the screw holes on its under side. These will come on the cross lines, and each will be ½ in. from the center line.

Now drill the preparatory holes (from the under side) for the flat-headed wood screws, using a drill somewhat smaller than the screws. We now have four holes that should register with the corresponding holes of the upper frame.

After securing the upper transom, carefully measure half the width and half the length of the truck frame, taken *as a whole*, to give you the location of the center pin.

Mark this point, but before boring the preparatory hole for the round-headed screw that is to form the pin, test its position with a pair of sharp dividers. If center pins are not accurately placed, your locomotive will assume a skew position. Now insert the flat-headed screws and tighten up with a small-shanked, sharp screwdriver, for access is not direct.

(*Continued on page 101*)



Two model railroad coaches, one having a motor-truck like that described in this article

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The Home Workshop

Simplified Model-Making

(Continued from page 100)

An alternative method of fastening the upper transom is to use the 1/8 by 1 in. machine screws. In this case, bore the holes in the upper frame with the drill that comes with the screws and use the tap that belongs to them. Do not countersink the holes. The holes in the transom must be fully 1/8 in. in diameter. Put the screws in from the *top*, and after they are tightened up, snip off their excess length with small-jaw wire cutters. Small brass washers under the heads of the screws are desirable. File the ends of the screws smooth and flush with the under side of the upper frame. This is important because a smooth, sliding contact with the swing bolster will be required at this point.

For the lower transom, which is of a smaller cross section, locate the holes in a similar fashion (Fig. 4), but remember that small round-headed screws, put up through the bottom frame, are used in this case. If they show through the top of the transom, file them flush.

The upper side of this transom will come within less than an inch of the upper transom, and, therefore, will interfere with the application of the screwdriver to the center pin. To forestall this inconvenience, make a 3/8-in. hole in the center of the lower transom; later on, you can make a corresponding hole in the pick-up shoe. You now are ready to attach the lower transom.

WITH both the end beams and both transoms in place, the truck should be tested on the flat slab. If any "teetering" now manifests itself, ease up on all the transom screws, but leave the end beam screws as they were. The truck now cannot get "out of square," although it may impress you as being too loose jointed. Do not be disturbed on that account because a slight slackness will compensate for the absence of equalizers. We omitted equalizers from our design because they would have complicated matters unnecessarily.

It now remains to make the swing bolsters and spring plates. For the former, cut a piece of 1/16 by 3/4 in. sheet brass, making it 1 in. longer than the width over the truck frames (Fig. 5). Square the ends carefully, and while you are about it, make a second bolster for the trailer truck. See that they match exactly in the matter of length, for if they do not, the spring plates later will be forced out of line, imparting a slovenly appearance to the whole locomotive.

Then cut four pieces from your angle brass stock for spring plates, making them a trifle in excess of 1 1/4 in. long, so as to allow for filing off the burr at the ends. These are for the spring plates, one of them belonging to each end of each swing bolster. Scratch a line across each bolster 1/8 in. from each end, using your square for this purpose. Then, with the drill belonging to your 3/32-in. machine screws, bore two holes exactly on the scratch and 1/8 in. from the side. Tap these holes.

(Continued on page 110)

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~Buy BROWN & SHARPE TOOLS
BROWN & SHARPE Tools are a good investment. You'll find their long-lived accuracy helps you do better work. The very fact that you use Brown & Sharpe Tools brings you the respect of the men you work with. You'll find that these tools really give your skill every opportunity to show at its best. That's why Brown & Sharpe Tools are the first choice for every tool requirement.
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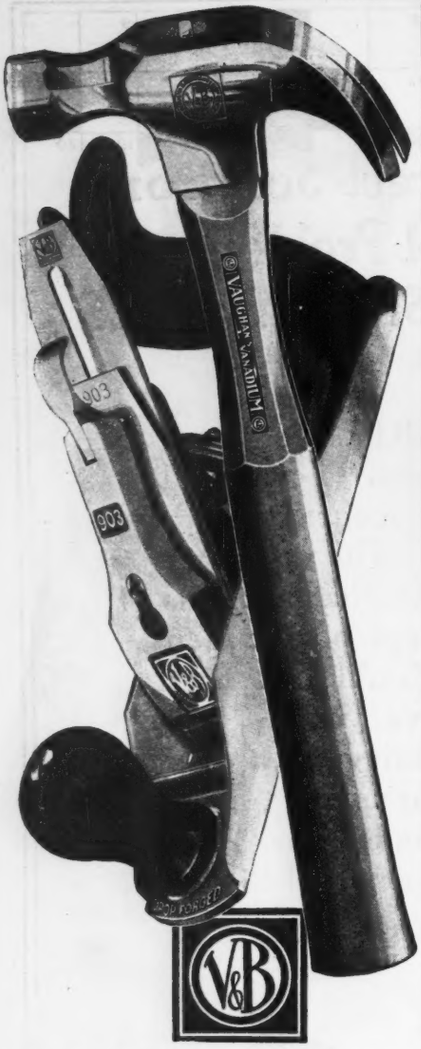


VAUGHAN & BUSHNELL Vanadium Hammers are aristocrats among hammers. Made from special formula vanadium steel—handled with the best grade hand-shaved second growth white hickory—designed with a special non-slip claw that grips either a brad or a spike— and equipped with a Vaughan's Expansion Wedge that firmly locks the handle tight—they are made for you craftsmen that buy quality tools.

V & B Unbreakable Planes bear the same reputation as V & B Vanadium Hammers. They are drop forged—not cast—from a solid bar of V & B Supersteel, and stand the falls and accidents that would break an ordinary plane. They are furnished with all vanadium steel blades and walnut handles in the sizes you'll want.

Your hardware dealer will heartily recommend these two tools. Ask to see them when next you are in!

Ⓢ

VAUGHAN & BUSHNELL MANUFACTURING COMPANY

Makers of Fine Tools

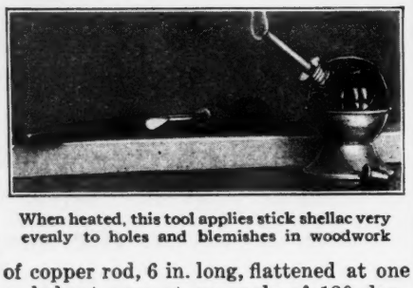
2114 Carroll Ave. Chicago, Ill. U.S.A.

The Home Workshop

"Duck Foot" Is Useful Tool for Patching Woodwork

DENTS or small holes in woodwork, especially in cabinetwork or furniture that is given a natural finish, are repaired with stick shellac, which is made in colors to match all kinds of finishes.

Finding it difficult to apply the stick shellac evenly, I devised the tool illustrated, which is simply a short length

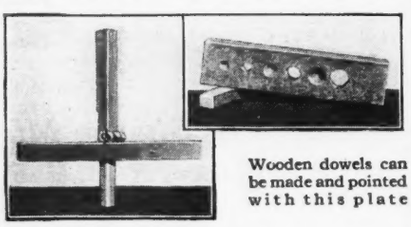


When heated, this tool applies stick shellac very evenly to holes and blemishes in woodwork

of copper rod, 6 in. long, flattened at one end, bent over at an angle of 120 deg., and fitted with a handle. In use it is heated in an alcohol flame and then applied to the stick until enough shellac is melted to fill the depression. It is then used much like a soldering iron. The flat part is rubbed over the patch when completed to obtain a smooth finish.

Plate for Preparing Dowels

THE dowel maker illustrated is an old piece of steel ½ by 1 by 3 in. with 3 holes ¼, ⅜, and ½ in. in diameter. The three countersunk spots of corresponding sizes were added to the tool for use in pointing the dowels after I read in the last November issue of POPULAR SCIENCE MONTHLY the article "Universal Dowel Sharpener Made from Steel Block."



Wooden dowels can be made and pointed with this plate

To make the dowels the wood is planed to about 1/16 in. larger than necessary and one end is tapered slightly to enter the hole. The wood then is hammered through.—H. CALDWELL.

Awl Made from Old Spark Plug

A SMALL awl or prick punch may be made by removing the firing-pin and porcelain from an old spark plug and filing the end of the pin to a sharp point. Heat this until cherry red and plunge into cold water. It then can be given a needle point on an oilstone.—L. B. ROBBINS, Harwich, Mass.

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USE SPARE TIME ONLY Most people *idle* away *fifty* hours a week. Probably you do. Use only one-fifth of your wasted hours for study and you can remove your present handicap within *two years*. You will enjoy the lessons and the knowledge you will gain will well repay the time spent in study.

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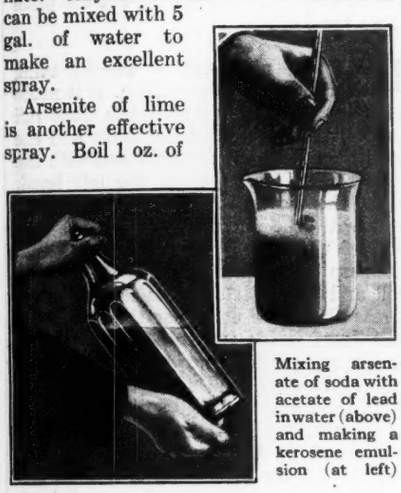
Home Workshop Chemistry

Simple Formulas that Will Save Time and Money

ONE garden spray will not kill all kinds of insects. If the insects eat the leaves, a poison spray must be employed; if they suck the sap of the plants without eating the leaves, oil or dust sprays are the only practical means of control. Sprays of both kinds can be made at home more cheaply than bought.

For insects that eat plants, arsenate of lead is one of the best poisons. It will not injure the most delicate plant. It consists of 3 parts by weight of crystallized arsenate of soda mixed with 7 parts of acetate of lead in water. These substances, when pulverized, readily unite and form a white precipitate of lead arsenate. Anywhere from 1 to 5 oz. of this can be mixed with 5 gal. of water to make an excellent spray.



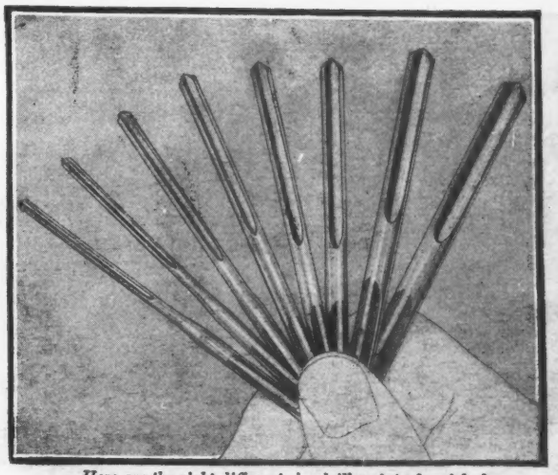
Mixing arsenate of soda with acetate of lead in water (above) and making a kerosene emulsion (at left)

Arsenite of lime is another effective spray. Boil 1 oz. of white arsenic with 4 oz. of sodium bicarbonate in ½ pt. water for 20 minutes, or until dissolved. One ounce of this stock solution, which will keep indefinitely, is mixed with 8½ gal. of water containing 3 oz. of freshly slaked lime.

A standard contact insecticide for sap-sucking pests is kerosene emulsion. Dissolve 2 oz. soap in 1 pt. water by heating to just below boiling. Take off the fire and quickly add 1 qt. kerosene and churn or shake vigorously. For the control of scale insects 1 oz. of this solution is mixed with 9 oz. water; for ordinary sap-sucking insects, with 15 oz. water, and for soft bodied plant lice, with 20 oz.

Disease-checking chemicals are primarily copper and sulphur compounds. A fungicide can be made by slaking ¼ lb. of burned lime (calcium oxide) with 1 qt. water; add the water slowly and stir constantly. Then add ½ lb. flower of sulphur or finely ground sulphur, and boil the mixture for an hour. Strain out the lumps and label. Each ounce is diluted with 9 oz. water if it is used before or after the leaves have made their appearance. When the plants are in full foliage, each ounce is diluted with 40 oz.

Handle all poisonous sprays with great care and keep them from children.



Here are the eight different size drill points furnished free with Mr. Punch, the Goodell-Pratt Automatic Drill.

Bores holes without a split

—that's what Mr. Punch, the Goodell-Pratt Automatic Drill, does

RADIO cabinets and other delicate, exacting work make this automatic drill more necessary today than ever before.

Through hard wood without splitting it, through soft wood without crushing it, through plaster without cracking it—quick, clean holes when Mr. Punch is on the job. You push — he twists.

Eight different size drill points ranging from 1-16 to 11-64 of an inch are furnished free with this drill—each kept in a separate compartment of the hollow handle. To get the drill point you want, merely turn the top cap of the handle and the point is released through the little top hole.

All exposed parts of this automatic drill are nickel-plated and highly polished. Drill is 10 inches long and weighs 8 ounces. A handy size.

Sold by good hardware stores everywhere. If your dealer hasn't it, write us.

Send for the book of 1500 Good Tools

Catalog No. 15 illustrates and describes each of the famous 1500 Good Tools made by Goodell-Pratt. Interesting and valuable for tool lovers. Write for a copy. No charge for it.

GOODELL-PRATT COMPANY Ⓘ
GREENFIELD, MASS., U. S. A.

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1500 GOOD TOOLS

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Americans will not wait

Accustomed to instant communication by telephone and telegraph, our military authorities realized in the late war that the American Expeditionary Forces could not depend on the communication services of Europe.

The necessary plans, materials and engineers were sent over in ship loads. A world record was made by the Signal Corps in establishing lines of communication indispensable to every branch of the army. In a surprisingly short time, every American general in France had at his disposal the communication facilities to which, in America, he had been accustomed.

Europe was sometimes startled by the amazing methods of the telephone workers from overseas. The American-trained Signal Corps units invariably sought the shortest way, overcoming all natural obstacles to extend the needed means of communication.

The Americans were not content to wait. They expected and demanded the same ever-ready telephone connections which they had at home. The Bell System has set a world standard for prompt attention and continuous service.

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The Home Workshop

How to Re-Upholster Chairs

(*Continued from page 79*)

the original one was, two sets of new springs were purchased. The old springs were moved to the position shown and fastened with nails to the corner blocks (Fig. 2). This illustration also shows the new springs being nailed to the side rails of the chair.

After the springs are in place, whether sewed to webbing or held in the manner explained, the next step is to tie the tops in a position to give the seat its shape.

Figure 3 shows the springs tied and the worker driving the last tack. In this particular operation you should keep in mind how the original job was tied and do the new work accordingly.

Tie a simple knot in one end of a piece of spring twine and drive a 10-oz. tack through it into the rail at a point in line with the center of a row of springs. Stretch your twine over the top of the springs to the opposite rail and, allowing about a foot of twine extra, cut the piece from the ball.

BEST of the knots to use for tying springs is the clove hitch. It is made as follows: Working from the front rail toward the back, hold the twine and the spring nearest the fastened end with the thumb and forefinger of the left hand. Hold the spring in the desired position and with the right hand pass the free end of the twine down inside the coil, then up and under the first loop of the coil and to the left of the fastened end. Draw this loose end over the tight cord and down inside the coil again, then up on the right side of the fastened end and run it through the loop thus formed. Slide the knot until the spring is exactly where you want it and tighten.

Proceed to the opposite side of the coil and tie the same kind of a knot, but in this case the twine first is passed down on the outside of the coil.

Before tying the second spring, be sure to space it at a top distance equal to the distance between the coils at the bottom. Continue across the row of springs, making a knot at every intersection of spring and cord until the opposite rail is reached.

Fasten the second end of the twine by driving a tack partway into the rail. Wrap the end once and a quarter around it in such a way that the slack end lies uppermost when the tack is driven in. After making sure that the whole row is tight and in the proper position, drive the tack securely. Drive a second tack through the loose end close to the first one. When fastened as described, long use of the chair will not cause the twine to be cut off through coming in contact with the head of the first tack.

How the springs look when all are in position and how the diagonal strands are tied are shown in Fig. 3. Take particular care in tying subsequent rows of springs, after you have done the first one, to keep an equal tension at all times.

In Fig. 4 you will notice that wooden strips, having their inside edges rounded off in order to prevent cutting the twine, are nailed to the rails. This is not always

(*Continued on page 105*)

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The Home Workshop

How to Re-Upholster Chairs

(*Continued from page 104*)

done, but in this construction it furnishes a much smoother and longer wearing edge. The illustration also shows how a piece of 12-oz. burlap is tacked over the springs. Notice how the corner is cut out to provide a smooth fit around the leg.

When tacking on burlap, it is well to turn the edges under as you go along. This gives greater strength. Tack the burlap over the springs only moderately tight, for the spring reaction should all come on the twine and not on the burlap.

Stuffing tow and roll-sheet wadding are shown in Fig. 5. Other materials such as kapok and moss also are used.

The stuffing is placed on the burlap and scratched about and piled up until the approximate shape of the seat is obtained. The wadding then is spread over the top and the corners are drawn down like the burlap. A few tacks are driven along the edges to hold it in position. Sometimes a few stitches are taken through the seat.

Muslin or ticking next is stretched over the whole (Fig. 6). The tacks are driven in only a short distance. This is called slip tacking and is necessary because in putting on the muslin you will have to draw out any wrinkles.

CONSIDERABLE patience is required in all upholstering work and at this particular point you may have to tack and retack a number of times before you get a smooth, unwrinkled surface. This is a good place to practice cutting out and fitting corners as shown in Fig. 7, and to gain practice in fitting a smooth edge against the legs so that when you put on the final cover you will make no errors. Figure 7 also indicates how the final cover is slip-tacked along the front rail.

When cutting out the corner to fit around the legs, be sure to take out only a small square at first; that is, do not try to get a final fit the first time, but gradually cut and fit until when you fold the edge under for the last time it will fit snugly against the leg on both sides.

Figure 8 shows a good position to assume when stretching on the final cover. The left hand draws the wrinkles out of the cover from the front toward the back while the right hand takes up the slack. Remember that you must be patient in doing this. You may have to remove the tacks from a whole side in order to remove some little wrinkle; so do not drive any tacks home until the surface is smooth.

The completed job is shown as the initial piece on page 79. You will notice the gimp or edging is in place, thus covering up the rough edges of the cover. A good rule to follow in spacing any ornamental tacks is to drive in the two end tacks first, then the center one. Drive two additional tacks at the centers of the spaces thus formed and divide all new spaces in a like manner.

In a future article the method of attaching webbing to a chair frame, how to sew springs to it, and also one method of building up a so-called "hard-edge spring seat," will be explained.

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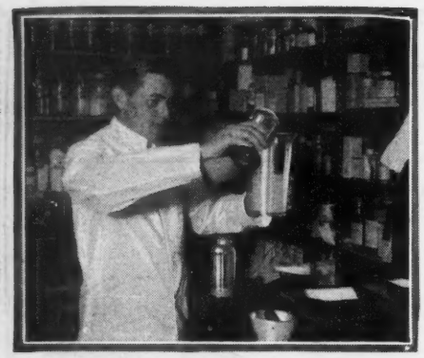

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The Home Workshop

Kitchenette for Camp Cooking

(Continued from page 80)

soldered. A board across the bottom of cabinet stays the metal sufficiently to support the lid, which is wood covered with metal. It makes a strong table.

The supplies were decided upon after three months' camping in a tent. Many apparent necessities at home are luxuries or a nuisance on such a trip.

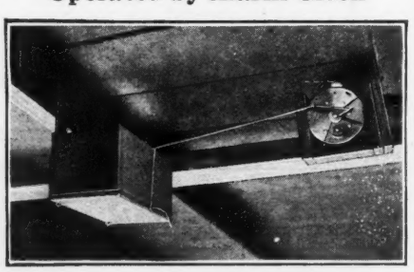
It was found to be more convenient to use a refrigerator basket than to build a refrigerator in the bottom compartment. However, a refrigerator can be made, if desired, by insulating the bottom, sides, and removable upper lid. Since the stove is used at every meal, this would rest with its container on top of the refrigerator, so that when it was removed the refrigerator lid could be raised. One such refrigerator has a drainage hole in the bottom with a small tin funnel passing through a hole on the runningboard. When height is added in this way to the case, a stay at the top will be necessary.

ALL containers are designed to hold amounts that can be purchased cheaply, that is 1 lb. of commercial shortening, which does not melt or get rancid like lard; a paper carton of salt, flour, sugar, cornmeal (especially necessary for frying fish and for hoe cakes), all placed in 2-lb. coffee cans; cocoa, mustard (for salad dressings), tea, and the like in ¼-lb. tea cans; rice, prunes, tapioca, and similar supplies in 1-lb. tea cans. The square tins waste no space as do round tins.

In the reserve space should be carried tins of peas, corn, Lima and baked beans, macaroni, beets, condensed milk, soup and spinach, and the like.

Too many campers on a long trip eat cold meals, or expend a great deal of money for restaurant meals, thinking that one can cook little en route. With a systematic arrangement like this kitchenette, one may have at a moderate cost good food with less effort than is usually exerted when preparing such a meal at home.

Automatic Feeder for Poultry Operated by Alarm Clock



IF YOU do not wish to attend to your poultry more than once a day, you will find an automatic feeder advantageous. Fasten a large box with an open top and a hinged bottom to the roof of the chicken house. Run a cord to an alarm clock as shown and place a wire hook at the end of the string over the alarm winding key in such a way that when the alarm goes off at noon, the key allows the hook to slip off, thus scattering the contents of the box.—R. C. TARR.

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Tests Show Ford Can Run 60 Miles On Gallon of Gas

The amazing fact that a Ford can run 60 miles on a gallon of gasoline was recently brought to light through tests conducted by America's foremost engineers. Great strides have already been made in this direction by the recent invention of a simple attachment which can be installed in a few minutes without any alterations to motor. A. C. Winterburn made 41.4 miles on 1 gallon of gasoline after this device was attached. B. O. Weeks, famous aviator and inventor, wants agents and will send sample for trial. Write him today at 426-800 Eleventh Street, Milwaukee, Wisconsin.

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The Home Workshop

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ANY one of the blueprints listed below can be obtained from POPULAR SCIENCE MONTHLY for 25 cents. The Editor will be glad to answer any specific questions relative to tools, material, or equipment. Blueprint Service Dept.

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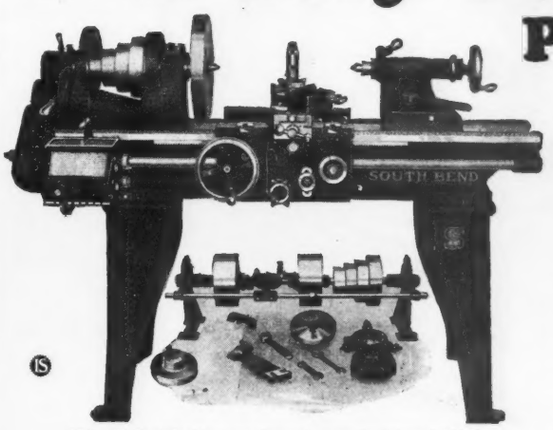

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The 1925 catalog shows all models in full colors. It is free. Write for your copy today. OLD TOWN CANOE CO., 1595 Main Street, Old Town, Maine, U. S. A.

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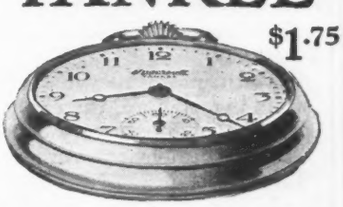

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Write for interesting circular

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Canadian Factory: 200 Notre Dame East, Montreal, Canada

PARKS
WOODWORKING MACHINES

The Home Workshop

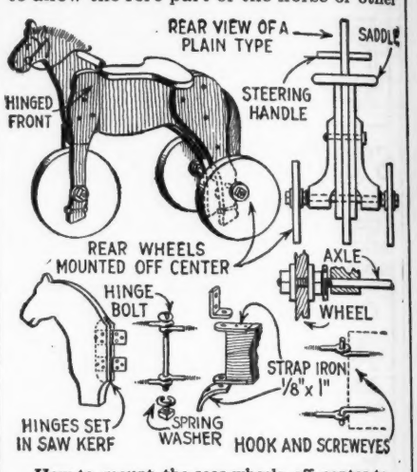
Kinks that Aid in Constructing Toy Horses and Cars

By Charles M. Miller
Assistant Supervisor of Manual Training, Los Angeles City Schools

MOST popular with the youngsters these days is a toy car with a framework that resembles a horse.

In making one of these horses, a realistic effect is obtained simply by placing the axle of the rear wheel off center about ½ in. The axle is a ½-in. rod, about 12 in. long, threaded at each end for 1⅝ in. Three washers and two nuts are used, as shown, in holding each wheel in place. The eccentric wheels must be adjusted so that their motion will be alike, otherwise the car will wabble.

Some kind of special hinge is necessary to allow the fore part of the horse or other



How to mount the rear wheels off center to get a galloping effect; various steering joints

animal to be turned for steering. A variety of construction may be used, a few types of which are shown.

If screweyes are used, they should be heavy, but the eyes comparatively small. Two butt hinges inserted in saw kerfs form a splendid joint. A long piano hinge, which can be bought by the foot at almost any hardware store, can be cut up to make an even better hinge. Two hooks and two screweyes also may be used, in which case the joint is assembled by temporarily twisting one pair sideways. Whatever kind of hinge is used, the joint must be pivoted on the center line of the body.

Dressing a Grinding Wheel

WHEN an emery wheel or grindstone has become glazed, lumpy, or lopsided, it can be restored by dressing it with a tool made as shown from a number of washers of equal size and a rod or long bolt. The washers should turn freely.

The bolt is rested upon the frame of the grinder so that the washers will come in contact with the rapidly revolving face of the wheel. Only enough pressure is required to keep the truing tool steady.

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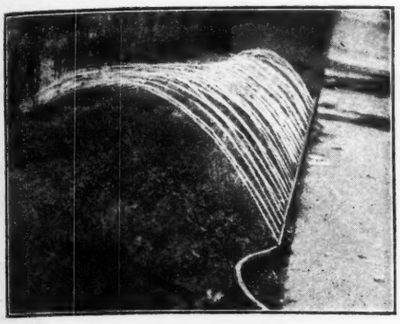
The Home Workshop

Easily Made Spray Waters Narrow Strips of Lawn

By Dale R. Van Horn



ONE of the best ways to water narrow strips of lawn is to purchase a 10-ft. length of ½-in. water or gas-pipe and after drilling 1/32-in. holes at 6-in. intervals, attach this to the hose. The far end of the pipe is capped.

Once attached to the hose, the pipe can be dragged where desired and, by kinking the hose slightly, any desired angle of spray can be obtained. If preferred, a quarter-turn elbow may be attached between pipe and hose; this provides a better way of holding the pipe at a correct angle.

Cabinet for Printing Photos

(Continued from page 81)

The illustrations (page 81) show the construction of the cover of the printing box. Its main features are the two wallboard shields, which are nailed inside the printing-frame opening. These prevent any direct light from striking the frame. A strip of ¼-in. beading runs around the under side of the cover to keep it in place when in use. This may be the tongues ripped from some matched boards or any small strips of soft wood.

The ruby lamp is constructed from a wooden box, having a sliding cover. In my case, it was picked up at a friendly grocer's. The cover is discarded.

Cut two pieces of clear glass, one fitting the groove for the cover, and the other slightly smaller, to fill the space just outside the groove. Screw a socket in place on the bottom of the box, the wire being led out of a small hole cut in one side, after being heavily taped to prevent leakage of white light.

The writer found that the use of two sheets of colored tissue paper, one orange, the other deep red, made a lamp that was safe to use with ordinary plates and film. By screwing the box to its supporting bar in an offset position, with the red side of the box down, a red light will be thrown directly on the work table, where it is most needed, and the lamp itself is out of the way.

The arrangement of screws on the back of the cabinet, as shown in dotted lines, makes it possible to fold the lamp and bar to one side and down, out of the way, when not in use.

All the corners and edges of the work-lamp box should be bound with heavy paper, to prevent leakage of white light.

More Power per Tube— Greater Economy— and Pride with

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1 to 5 tubes for loop or antenna

Only *CIR-KIT* brings you the fundamental advantages which make Supereflex more powerful tube for tube. With one tube doing the duty of three; with three tubes rivaling five in conventional arrangements, Erla Supereflex circuits excel in power, with less tubes to buy and operate.

Originally made possible by the special design of Erla Scientific Precision Apparatus, Supereflex circuits are most perfectly constructed with Erla Supereflex *CIR-KIT*. With this complete assortment of genuine Erla parts; with screwdriver, pliers, and an evening's time, you can follow the simple *CIR-KIT* instructions to a finer radio receiver. Its construction, range, volume, selectivity and typical Erla tone clarity will give you cause for endless pride. And you will be money ahead.

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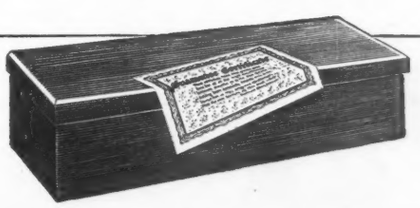

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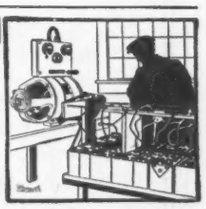

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Where to Look for Speedy Improvement

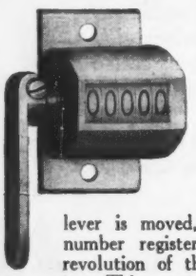
IS there any machine that can't be improved—or better operated? It's not so recorded on a Veeder counter.

When a counter goes on, production *goes UP;* the inventor gets busy or the operator gets busier on the job.

Production only goes backward when nobody's looking. You're always looking for speedier records — and getting what you *look* for—on

Veeder COUNTERS

This small Rotary Ratchet Counter (No. 6) counts reciprocating movements of the lever, as required for recording the output of innumerable small machines. When the lever is moved through an angle of 40 to 60 degrees, the counter registers one. The further the lever is moved, the higher the number registered. A complete revolution of the lever registers ten. This counter can be adapted to no end of counting purposes, by regulating the throw of the lever. Price $2.00. (*Cut nearly full size.*) Small *Revolution* Counter, also $2.00.



The Hand Tally illustrated below is used for counting anything from number of people in a public place, to number of packages in an inventory. In the factory or store it counts *stock;* in the "open" it may count anything from cattle on a ranch, to poles on a telephone line! Registers one for each pressure of the thumb lever; counts up to 10,000, then repeats. Can be set back to zero from any figure by turning knob once round. Size, exclusive of finger ring, 2 inches greatest diameter. Price, $5.00

Write us about that counting problem of yours—or see how it's solved in the Veeder booklet; copy free.

The Veeder Mfg. Co.
44 Sargeant St. Hartford, Conn.

The Home Workshop

Simplified Model Making

(Continued from page 101)

Place an angle brass across the end of a swing bolster, so that the latter abuts firmly against the *interior* angle of the former. See that it fits snugly, is square and projects equally at each end. Next clamp the combination in the vise in such a way that one of the tapped holes in the swing bolster is clear of the vise jaws, and, using the hole in the swing bolster as a templet, drill through the spring plate. Insert a 3/32-in. screw through the spring plate until its head comes firmly against the latter. Then remove from vise, snip off the excess length of the screw, and file it smooth. Treat the remaining hole similarly.

THERE are four such jobs as this, all requiring care and patience, but their reward will be an easy riding and pleasing locomotive.

It remains to locate the hole in the swing bolster for the center pin. Remember the stress that we have laid upon the accurate placing of center pins. Be equally painstaking in boring this hole. Last of all, don't forget to file the bevel on the inner edges of spring plates, as in Fig. 6.

Before attaching the pivot-spring rigging, it may be necessary to remove one of the spring plates, in order to pass the outfit through the frames and between the wheels. Be sure to place the $\frac{1}{8}$-in. washer around the center pin before tightening it; then slack up just enough to leave an easy sliding contact between the swing bolster and the upper frames.

We now are ready for the pick-up and return current shoes. The former is a piece of spring brass stock, not less than $3\frac{1}{4}$ in. long. It is attached to the middle of the under side of the lower bolster. In this position it will be seen that it covers the hole we have left for the screwdriver; but this can be overcome either by making a corresponding hole in the shoe, or by cutting a $\frac{3}{8}$-in. slot far enough back to clear the hole.

BEND the shoe approximately as in Fig. 7, but see that there is always a *bend*, never a *sharp* angle. The attaching screws may be placed so as to form a letter V, with one of the three screws at the point of the V preferably nearest the spring end of the shoe. Give the shoe just sufficient pressure on the third rail to keep it always in contact, but never let it bear hard enough to act as a brake.

The return current shoe is simply a piece of 1/16 by $\frac{1}{4}$ in. brass, long enough to reach from the outer edge of the end beam to about $\frac{1}{4}$ in. beyond the nearest axle. It can be bent sufficiently by eye before attaching, but must have no sharp angles. Fasten it with a broad-headed brass wood screw to the end beam farthest from the gearing. Put a small brass washer under the head of this screw.

Next month we shall explain the method of mounting the motor on its truck and, perhaps, say something about the body and wiring.

How Springy the Bristles Feel!

The best painters are — WHITING-ADAMS BRUSHES.

Get a *good* brush — one that will last and give years of satisfactory service. WHITING-ADAMS BRUSHES give the kind of service you want.

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WE will pay you $4 to $6 a day for making 2 to 3 doz. pairs standard Steber socks daily on High-Speed Family Knitter for five years. Written contract. Yarn FREE. Work at home. All or spare time. Be independent. Thousands earn guaranteed pay under this plan. Old reliable manufacturer. Send 2c for particulars without obligation.
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INSIST UPON AMSCO RHEOSTATS FOR ALL TYPES OF TUBES

The Home Workshop

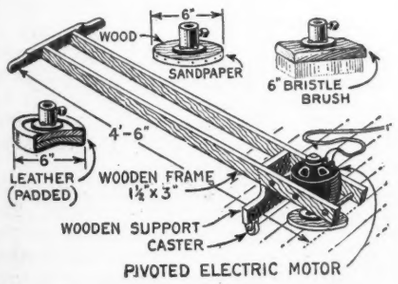
Miniature Log Cabin Improves Appearance of Mailbox

REALIZING that their common sheet-metal mailbox detracted from the appearance of the beautiful country road, the women on a farm in northeastern Iowa built a little cabin of twigs around the mailbox and fenced the supporting post with sticks of larger diameter nailed together in rustic fashion. To insure the solidity of the miniature cabin, two steel braces were run from the post to the floor of the metal box.—F. L. CLARK.

How to Adapt a Small Motor for Finishing Floors

A SMALL portable electric motor or a fan motor can be adapted easily for removing varnish from floors, sandpapering the wood, and waxing and polishing the finished surface.

A wooden frame is made as shown. If a fan motor is used, the ends of the wooden frame are drawn together with light bolts so as to grip the body of the motor. If the motor has center trunnions, these can be inserted in corresponding holes bored in the framework. A motor with a base is fastened to one arm of the frame and long bolts are used to stiffen the other arm. The shaft should

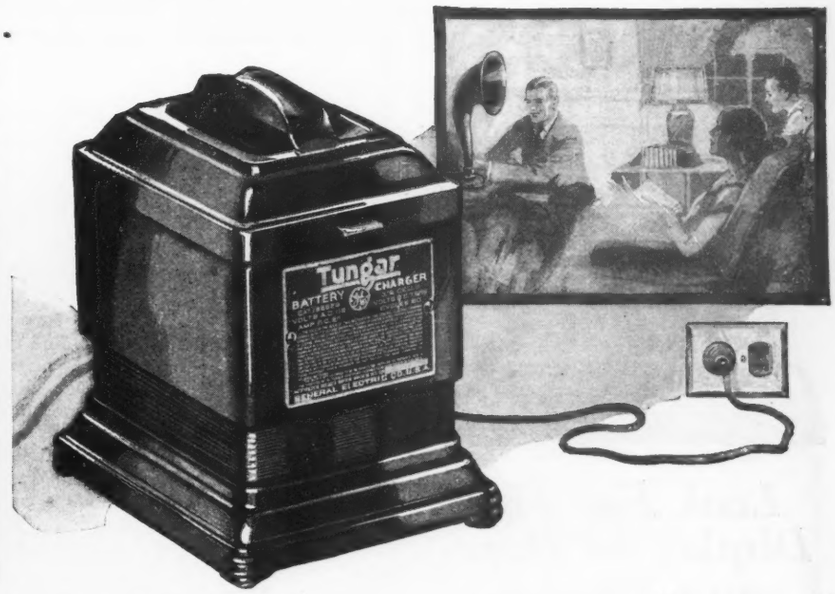


Small motor mounted for use in finishing floors and three of the several attachments

be placed so that it will be perpendicular to the floor or nearly so.

Three interchangeable floor tools are used. One is a sandpaper disk, the second is a heavy bristle brush, and the third is a polisher of wood faced with padded leather. The brush is mainly for removing paint or varnish and in conjunction with loose, fine sand scattered over the floor.

The method of connecting these disks with the motor shaft will vary. Only small disks should be used so as not to overload the motor, but a little practice will give excellent results from this improvised floor finisher.—A. L.



KEEP reception clear!

Keep it clear. Keep it loud—with all the volume your set should have. Keep the battery at top notch—fully charged—peppy.

The Tungar charges your storage battery overnight while you sleep—and at a cost of hardly more than five cents. It's easy! Just two clips—and a plug for the house current. Or you can make a permanent connection, and just throw a switch. Keep your set at its best all the time—with a Tungar.

The Tungar is a G-E product, developed in the great Research Laboratories of General Electric.

The New Model Tungar charges Radio A and B storage batteries, and auto batteries. Two ampere size (East of the Rockies) $18.00

A Tungar is also available in five ampere size, design unchanged (East of the Rockies) . $28.00

60 cycles—110 volts

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BATTERY CHARGER

Tungar—a registered trademark—is found only on the genuine. Look for it on the name plate.

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GENERAL ELECTRIC

$25.00 in PRIZES See top of page 8 in front of book for details.

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Demonstrate Once—Results Mean Sure Sale
Coast to coast, lowest prices, attractive four-tube instrument $39.50. Big commission to you. Exclusive territory to proven salesmen. Territory going fast, write today for large illustrated book No. 100. Don't fail to name your county.
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NEW Does Work of $100 Machine. Total Visible at all Times.
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Just write "Send me a Baby Calculator" and give your name and address. We will ship it immediately, all charges prepaid. On delivery pay postman $2.50. You can return it after 10-day trial for full refund if the Baby Calculator is not the greatest time and labor saver you ever used. This is the lowest priced practical calculating machine made. Order today.
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AGENTS
Everybusiness firm man or woman, will buy the Baby Calculator on sight. BIG COMMISSION.

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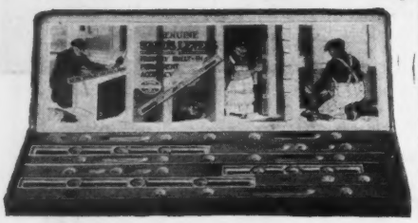
SAND'S LEVELS



Look For This Display In Hardware Windows

It's your assurance that such dealers handle the genuine Sand's Levels—the kind master craftsmen prefer.

A Complete Assortment Of The Most Popular Sand's Levels

Step in and look them over. With such an assortment of levels side by side you can quickly choose the style best suited to your needs.

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"Sand's Levels Tell the Truth." You can depend on their accuracy on your most particular work. Accurate workers must have accurate levels. If you are an amateur doing odd jobs about the home or shop, there is no level like the genuine Sand's to help you make amateur work more like that of the professional.

If you like good tools, you'll appreciate the advantage of a Sand's wood or aluminum level.

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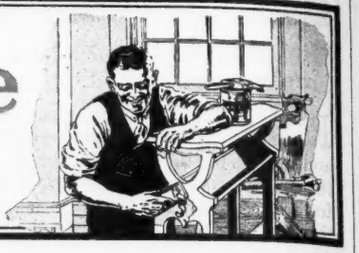
The Shipshape Home



Hanging Screen Doors

AMATEUR carpenters usually find the hanging of screen doors rather difficult. By following the correct methods, however, good results are certain.

The outside of a screen door is that side to which the netting and screen mold are applied. Lay the door down on a pair of saw horses and cut off the stile projections ("horns" or "lugs," as a carpenter would call them). Stand the screen against the opening and note the width.

If there is considerable stock to be cut off, joint the lock stile straight and slip it into the opening, with the hinge stile bearing against its jamb. Have some one trace the outline of the jamb on its stile and rip to the line, afterward smoothing it carefully. Slip it into the opening, or if it is still too wide to go against the stops, scribe the stile again and plane off the excess stock. Allow 1/16 in. clearance at both edges of the door.

With the door in place against the stops, wedge up the bottom and one side, and scribe the top rail to the head jamb, using scribers or a compass. Saw and plane to the line and test in position. Then fit the bottom of the door, allowing as little clearance above the floor or linoleum as possible, as otherwise flies will crawl under. Many back doors close against the ends of the porch flooring as a bottom stop, thus effectually barring flies. A front-door screen, however, usually closes with the bottom rail against the slope of the sill, and must be beveled on the bottom to fit.

Attaching the lower spring hinge. Note the extra butt hinge at the center of the stile; it aids in keeping the screen door from warping

In case the door is too long to go into the opening for scribing the stile, try the jambs for straightness with a straightedge, and test the head jamb for squareness with the sides. Cut the door to a tight length, making allowances for variations in squareness in the jamb, and cutting off excess stock from the bottom rail. Then proceed as above.

Having secured a good fit, with the edges of the door beveled sufficiently to clear in opening and shutting, wedge the door tightly against the hinge jamb by means of shingle points or other broad wedges, leaving proper clearance at top and bottom.

Now measure up from the bottom 11 in. and down from the top 7 in., and put on the spring hinges. To mark for screw holes, hold the hinges firmly in place, which requires considerable pressure against the spring tension, and trace the holes with a lead-pencil. Drill small holes to start the screws in, or if the casing is of soft wood, punch them with a nail set. Screw on the hinges, and remove the wedges. The door should show proper clearance.

If working clearance is given the rear stile while the hinges are being put on, in nine cases out of ten the hinges will spread sufficiently to make the lock stile strike on shutting, necessitating their removal, plugging of the holes, and resetting. It is never a fault to have very little clearance at the hinge stile, as the hinges nearly always loosen up with use.

Insufficient seasoning of the material out of which the door is built, especially if the afternoon sun shines on the door, often results in the stiles' springing until the centers strike the stops, so that the door will not close. An effectual remedy is to put on an ordinary butt hinge at the center, which will keep the stile straight. The stiles can be moistened with water and allowed to dry while wedged to a curve in the opposite direction; but this is an expedient rarely used.

Put the handle about 3 ft. from the floor, and the hook eye opposite. The hook never should be attached to the door, for inevitably it flips around when the door swings shut, preventing it from closing properly and marring the casing and jamb.

Repairing a Carpet Sweeper

TO REPAIR the worn tire of a carpet sweeper, remove the old tires completely and replace them with new rubber tires made from a ⅝-in. wide section cut from the union or thickest part of a Ford inner tube 30 by 3½ in. Apply a thin coat of glue or shellac to the wheels to insure the rubber's sticking fast.—J. A. CAPELL.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 21.

The Shipshape Home

Window Ventilator

TO AVOID a draft in my bedroom where one of the windows is kept open at the top, no matter how cold and windy the weather is, I made a ventilator as shown from ¾ yd. cretonne left from window draperies.

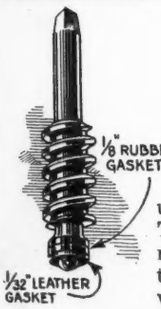
I stitched a hem 1½ in. deep at the top and bottom of the piece. Through these

A quickly adjusted ventilator

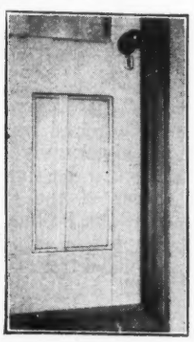
casings I ran a pair of spiral spring sash rods costing 10 cents each and hooked the clamps over the window frame. The result is that my ventilator is pretty as well as practical. It can be adjusted at the bottom or top of the window, as desired.—W. F. Z.

Washers for Faucets

TO REPAIR any compression faucet so that the washers will last longer than usual, replace the old rubber or leather washer with a washer cut from ⅛-in. gasket rubber and faced with thin leather. The facing may be cut from the upper of an old shoe. The rubber furnishes the necessary resiliency and the leather resists long wear.—TOM J. PARADY.



Repairing Door Panel



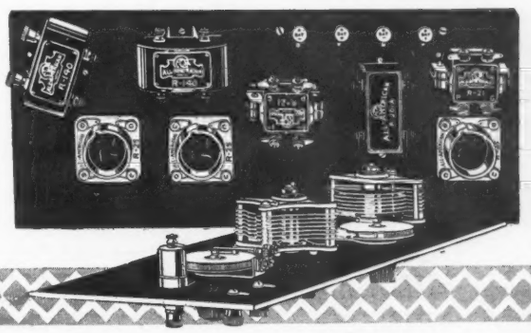
A CRACKED door panel, especially one in an outside door, is difficult to repair. Putty and even calking often will fall out. If the crack is covered with a narrow strip of adhesive tape, however, the repair will be satisfactory. The surface first should be cleaned thoroughly and the adhesive strip well heated. After it is covered with a heavy coat of shellac, the strip may be painted —WILLIAM C. SERRELL.

Radio at its Finest—

Now Within Your Reach

RMA

This is Not a Kit!

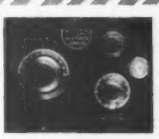


Semi-Finished — Factory-Mounted

YOU buy this set with the ALL-AMERICAN parts properly mounted on the panel and baseboard. Without knowledge of blueprints, circuits or names of radio parts, you can wire up an ALL-AMAX SENIOR in *one delightful evening* and *know* that it is *right*. This completely mounted highly efficient three-tube set costs you no more than you would pay for a kit of parts. Price, $42.

Ten cents will bring you the new Radio Key Book, and upon request we will include, free, a complete wiring blueprint of either ALL-AMAX SENIOR or ALL-AMAX JUNIOR.

ALL-AMERICAN RADIO CORP.
E. N. Rauland, *President*
2668 Coyne Street, Chicago



ALL-AMAX JUNIOR
A one-tube set that brings in the local stations on the loud speaker, or tunes them out and gets real distance. All parts are mounted on panel and baseboard, and clear *photographic* wiring directions are included. Price . . . $22

WIN AN ALL-AMAX RECEIVER
at your favorite radio store. Ask them about the great ALL-AMERICAN Slogan Contest. You can win a set by submitting a SLOGAN. Everybody can enter. It costs nothing.

ALL-AMERICAN

SIMONDS
FARM AND HOME SAW

Repairs to be made—odd jobs to be done—that is the call of Spring. So Spring calls for Simonds Home and Farm Saw with teeth that bite their way smoothly and easily through the toughest board. In the Home and Farm Saw, Simonds has produced a cutting tool worthy of the name. Confining manufacture to one size—24 inches long—Simonds is able to offer the Home and Farm Saw at $2.00—a price that is actually less than you *thought* you would have to pay for an *ordinary* saw. Ask your hardware dealer about this saw today.

SIMONDS SAW & STEEL COMPANY
Fitchburg, Mass.
"The Saw Makers" *Established 1832*
Branch Stores and Service Shops in Principal Cities

SIMONDS
Pronounced SI-MONDS
SAWS FILES KNIVES STEEL

Better Shop Methods

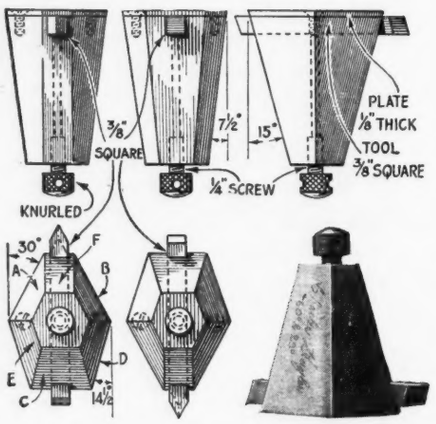
(*Continued from page 86*)

Fixture for Grinding Thread Tools

By Charles Kugler

EASILY as it may be made, this fixture makes possible the speedy grinding of U.S.S. or 60-deg. thread tools and Acme or 29-deg. tools. Either type of tool can be ground at one setting.

For example, to grind a 60-deg. tool, the sides *A* and *B* are placed on the magnetic chuck of a tool-grinder and the two sides of the tool ground to 60 deg. Then the fixture is placed with the side *C* on the chuck and the 15-deg. front angle is ground. After that the side *D* is placed down and the top of tool is ground. Side *C* is used only when a U.S.S. tool is desired to make a flat on the thread. For a V thread this is not necessary. For an Acme 29-deg. thread the sides *D*, *E*, *F* are used.



With this fixture and a magnecic chuck, both standard and Acme thread tools may be ground

The central screw makes the tool fast in the slot by exerting pressure on a 1/8-in. rod.

With this fixture a precision thread tool may be ground in a few minutes, yet the work involved in making it is not great; a machinist can make one in four hours. The writer made the one illustrated of machine steel and pack-hardened it.

Wristpin Bushing Tool for Rapid Work

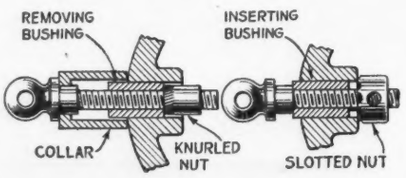
Useful both for insertion and removal

By Harvey Mead

THIS tool for inserting and removing wristpin bushings has given very good service and is easy to make. The dimensions can be made to suit the work.

The inside diameter of the collar must be just a little larger than the outside diameter of the bushing. The knurled nut has an outside diameter slightly smaller than the outside diameter of the bushing.

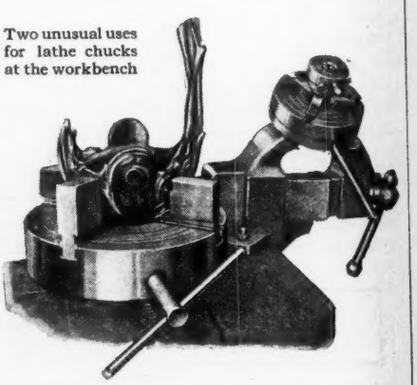
To insert a bushing, place it over the screw, locate the toothed or slotted nut between the bosses in the piston with the milled slots against the boss, and with a bar as a lever, turn up the screw until the bushing is in place.



How the wristpin bushing tool is made and used. The photograph at the left shows the insertion of a bushing; that above, its removal

To remove a bushing, place the collar, open end last, over the screw. Pass the screw through the bushing and start it into the knurled nut. Let the open end of the collar bear against the piston and tighten the screw.

Lathe Chuck Supplements Vise for Bench Operations



Two unusual uses for lathe chucks at the workbench

FOR hand work at the bench, a lathe chuck may be used to hold such an irregular casting as that shown in the larger of the two chucks above. The chuck is bolted to the bench and jaws adapted to grip the part to be held are provided from soft blanks.

The smaller chuck, which is held in an ordinary bench vise, is gripping a finished automatic-die for disassembling and reassembling. In this manner the product is held securely without marring the finished surfaces, as would be done by attempting to hold the cylindrical member between parallel jaws.—O. S. MARSHALL.

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Better Shop Methods

Old Bill Talks to the New Machine-Shop Apprentice

TOMMY JONES, who had been in the shop only a week, was like a colt fresh from pasture.

Old Bill had been keeping a watchful eye on him. As Tommy was going out on Saturday, Old Bill told him to wait a while. After every one had gone they went into the office, Tommy a bit suspicious. Old Bill soon put him at ease.

"Tommy," he said, "it has been my custom for years to take boys into the shop on trial. I have noticed that you have done unusually much playing. The shop is no place to fool. It is dangerous and you easily may be injured for life.

"Get yourself overalls tonight and don't come Monday morning without them. Never wear any loose fitting

clothes or long sleeves around a machine-shop unless they are buttoned up tightly about the wrists; roll up your sleeves above the elbows or, better, have them cut off short.

"Never place your hand near a revolving cutter to brush away chips, but use a soft wood stick or a brush, or stop the machine. Always make use of any safety devices provided for the machines, especially grindstones and emery wheels. Never remove the guards.

"The tools, machines and materials that you will use are expensive, many of them very expensive. If there is anything you do not understand about your work or the machines, you must always ask some one who does. If you had to buy these machines and tools yourself, you would have a great deal of regard for them. Oil your machine each morning before starting up. Never place files, heavy wrenches, and tools or rough castings on the ways of a lathe. Never use a monkey-wrench in place of a toolpost wrench or machine-vise handle; this practice ruins the screw in a short time.

"If you have to shift gears on a machine or change the stroke of a planer, always stop the machine. Get the proper speed and feed for every operation. Machines do not get tired, and if you work with your head you can make the machines do the physical work.

"Learn the value of little things. Never slight a job, no matter how unimportant it may seem to you. Do everything as well as you know how. Pay no attention to what the other fellow is doing, but concentrate on your own job."

Better be *sure* it's "Good old 'B.V.D.'"!

"B.V.D." Union Suit (Patented Features) Men's $1.50 the suit Youths' 85c

"B.V.D." Shirts and Drawers 85c the garment

Men's "B.V.D." Underwear in Fancy Materials at Various Prices

REMEMBER that *no* underwear without the red woven "B.V.D." label *is* "B.V. D."

Assure yourself of that Famous Fit, Long Wear, and Cool Comfort which have kept "B.V.D" the world's most popular men's underdress.

Get the underwear you ask for! *Insist* upon *this* red woven label:

MADE FOR THE B.V.D. BEST RETAIL TRADE

Trade Mark Reg. U.S. Pat. Off. and Foreign Countries

The B.V.D. Company, Inc. New York

Sole Makers of "B.V. D." Underwear

853 *"Next to Myself I Like 'B.V.D.' Best"* ©1925 The B.V.D. Co. Inc.

A new grease cup or hub cap for less than 1¢

Stop that leak in a jiffy with SMOOTH-ON No. 1

Makes no difference whether it's water leaking from the hose connections or radiator, oil or gasoline from the supply lines, or gas from a loose exhaust pipe, Smooth-On No. 1 will produce perfect tightness in a few minutes.

Use it also for keeping grease cups, lock nuts and hub caps from dropping off, and for perfect sealing of cracks in bursted water jackets.

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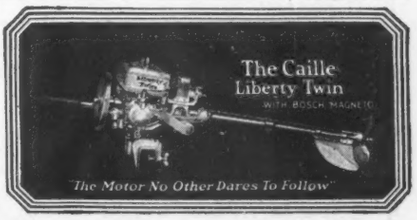

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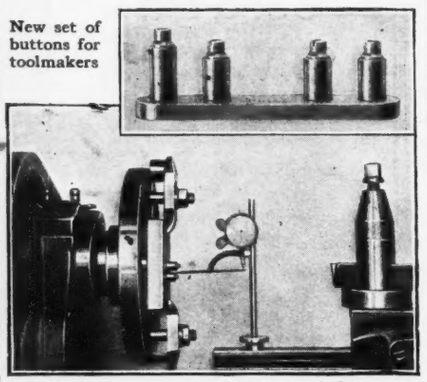
Better Shop Methods

Toolmaker's Long Button Is Useful for Close Work

SO LONG accustomed have machinists been to the standard design of toolmaker's buttons that they will be quick to note the outstanding feature of the new set illustrated below, which was developed recently by a manufacturer of precision



New set of buttons for toolmakers

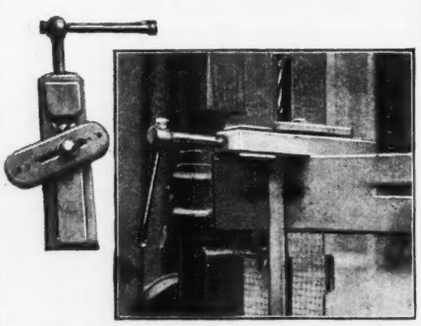
tools. The difference is simply that one of the buttons in the set is made a little longer than the others.

The advantage of the long button lies in locating holes that are close together. It is possible to use an indicator to center the long button even when a short button is placed close to it.

Adjustable Fixture Holds Rod Ends for Rapid Drilling

IT IS often a laborious task to center-punch the ends of rods that are to be drilled. Another difficulty is to place the rod ends in a vise so that they may be drilled straight. The same trouble arises in milling the end of a rod.

To overcome these difficulties and hold any rod in a vertical position, the device illustrated was made. A hardened die with holes of the sizes most in use, can be



The fixture opened to show the V-shaped movable jaw, and how it is used to hold a ¾-in. square iron rod for drilling in the end

set so that the desired guide hole is exactly over the center of the rod.

A stud bolt with wingnut allows the fixture to be fastened to almost any drill faceplate. Within their capacity the jaws will hold any shape iron, square, round, hexagon, oval or flat.

For milling the ends of rods, all that is necessary is to take off the guide die on top.—O. W. MIELENZ.

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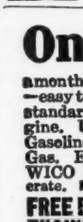

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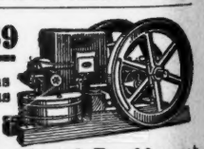

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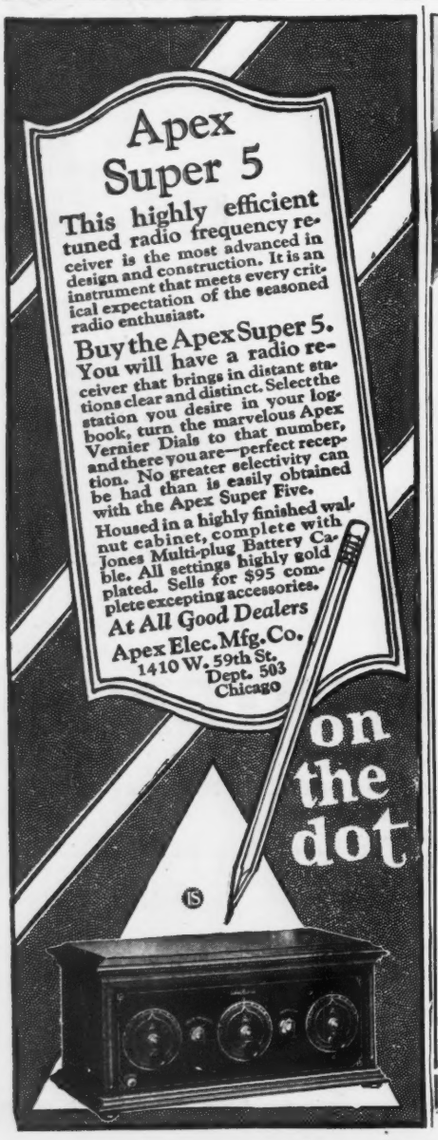
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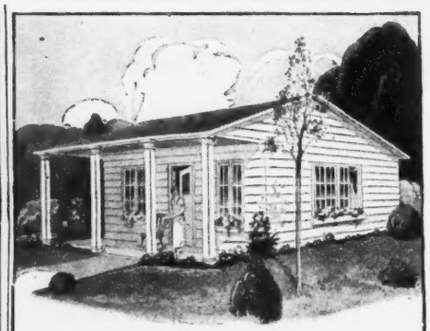

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1310 Grand Street, (House Dept.)
BROOKLYN, N. Y.

Better Shop Methods

Old Bill Works on Teeth

(*Continued from page 84*)

teeth of 2½-in. pitch and weighing about 350 lbs. in the rough to another with ⅜-in. pitch, which could be held in one hand, yet that was the variety of work that Old Bill had, and the variety of work that confronts many a general machinist.

"How soon can you make it for me?" the customer asked.

"I can get it out right away," Old Bill said, and looked at his watch. "You can have it late this afternoon if you want it."

The pinion was of cast iron and had several of its teeth broken out. Old Bill decided that he would make his new one of steel, for he knew that it could be done in about the same time as the cast one, and would be much stronger.

The remaining teeth were so badly worn that it was not possible to tell how large the outside had been in the beginning, so methods somewhat similar to those used for the big pinion had to be used for the smaller one. This was a little bit simpler than the larger one, for the smaller one was made with teeth proportioned by the diametral pitch.

"THERE is a difference," Old Bill explained to the machinist who was to make the gear. "Somebody decided that it was too much trouble to figure circumferences and divide, and then look at tables, so they made a system of gearing that hardly takes any figuring.

"If you know the number of teeth, and the diametral pitch, divide the number of teeth by the pitch and you will have the pitch diameter. For the outside diameter, add two to the number of teeth and divide as before, which will give you the outside diameter. This pinion has 20 teeth, and it is 8 pitch. Twenty-two divided by 8 gives 2¾ in., which is the size that you are to turn the blank.

"Pick the eight-pitch gear-cutter in the milling machine cabinet marked '17 to 20 teeth.' This is numbered 6. The depth to cut is marked on the side of the cutter and is .270. Be sure that you have the cutter in the center of the blank before you start cutting, then just barely touch the blank with the cutter. Move the table away and raise it just .270 in. and start to work."

OLD BILL passed through the shop, looking around to see if any one was in difficulty. He observed that the large pinion blank was getting along well. He was going to have a man stay to work on it that night, so he returned to his office to get the paper templet.

"I have made this paper gear," said Old Bill; adding with a smile, "It will not be as easy for you to make a steel one as it was for me to make the paper one, but the teeth should be the same shape!"

The machinist looked at the templet, and measured the diameter with his rule.

"When you get the blank out of the lathe," Old Bill resumed, "hold this templet tight on one end and scribe the outline of the teeth on the steel. Better take a prick punch and mark the teeth

(*Continued on page 120*)

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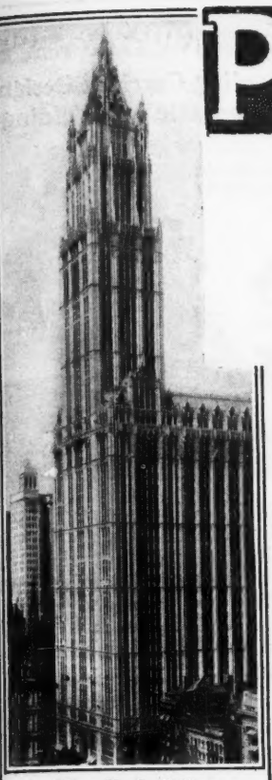

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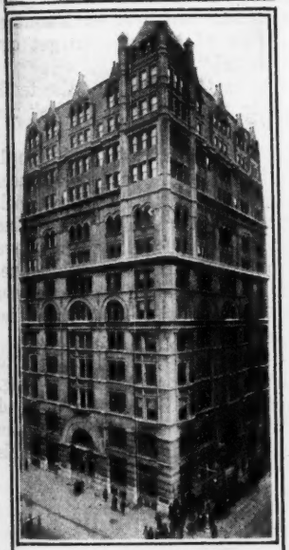

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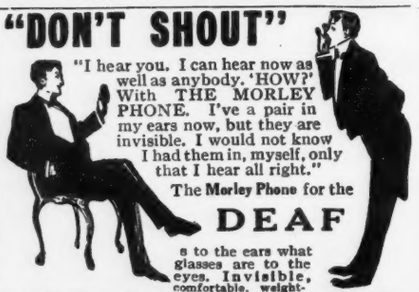

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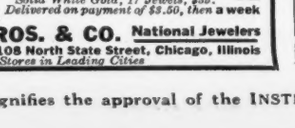

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Better Shop Methods

New Traveling Carriage Designed for Automatic Arc Welding

Welding a straight seam automatically

TO SPEED up the production of straight welded seams, the traveling carriage illustrated was developed recently. The unit consists of an automatic welding head and the necessary controlling mechanism, a motor, and a wire reel support mounted on a framework that rolls along a track.

Old Bill Works on Teeth

(*Continued from page 118*)

well. Then get the gear in the big shaper and plane the teeth to shape. I will have a tool made for you to use in finishing the sides of the teeth. But first use a square-nose tool about 3/8 in. wide to get out most of the metal."

"I ought to rough out all of the teeth before I try to finish any of them," the machinist commented.

"Yes, that's the idea," Old Bill agreed. "Set up the blank with one of the spaces vertical and go down with the square tool. You might work out almost to the line with a round-nosed tool after you have got to the bottom with the square one. When this is done on all of the teeth, you can use the formed tool to give them the proper shape."

Old Bill went by the milling machine to see how the little pinion was progressing. It was almost done. Both jobs, big and little, would be ready on time and, he knew, a credit to the dependability of his shop.

Spring Cover for Spindle End

THE spindle ends of emery wheels in toolrooms and shops very seldom are guarded. An inexpensive guard can be made as illustrated from a piece of tubing tapped on the inside of one end and plugged. Three or four flat springs are riveted inside, as shown, to hold the tube in place on the spindle.

WHILE it is common practice to put a board on the flanges in the bed of a lathe to hold tools, it is better to use a piece of heavy wire netting cut to fit in snugly. This lets much of the dust and chips fall through.

Better Shop Methods

Precision Boring-Tool Will Assure Accurate Work

By H. L. Wheeler

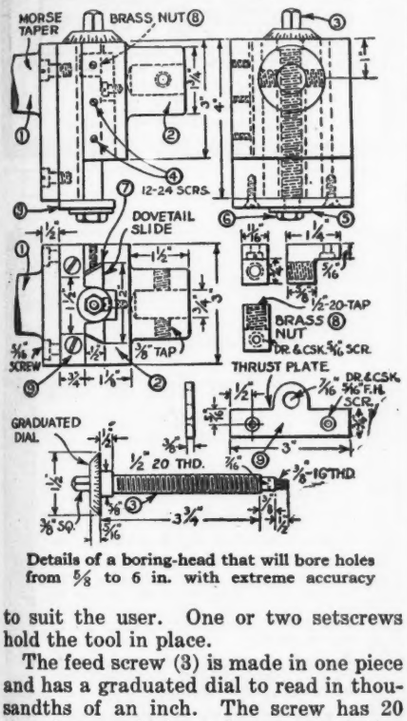
Machine-Shop Foreman

THE boring-head detailed below is for boring holes in drill jigs and dies and similar work where extreme accuracy is required.

There are three main parts, the base, the slide (2), and the shank (1). The base and slide are dovetailed and provided with a gib (7) ⅛ in. thick, which is adjusted with three headless setscrews (4) on the side of the base.

The shank is fastened to the base with four fillister-head screws from the under side. The heads of these screws are sunk in counterbored holes flush with the back.

A ¾-in. hole is provided for the boring-tool, but this dimension may be changed



Details of a boring-head that will bore holes from ⅝ to 6 in. with extreme accuracy

to suit the user. One or two setscrews hold the tool in place.

The feed screw (3) is made in one piece and has a graduated dial to read in thousandths of an inch. The screw has 20 threads to an inch, so that one revolution of the screw moves the tool .050 in.

The brass nut (8) is fastened to the slide with a fillister-head screw. The nut fits snugly into the groove in the under side of the slide and cannot work out of place. The thrust plate (9) is fastened with flat-head machine screws.

The material used is machine steel. A boring-head of the size shown will bore holes from about ⅝ in. to 6 in. in diameter. Various styles and sizes of straight-shank boring-tools may be made up.

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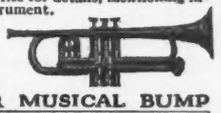

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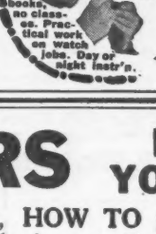

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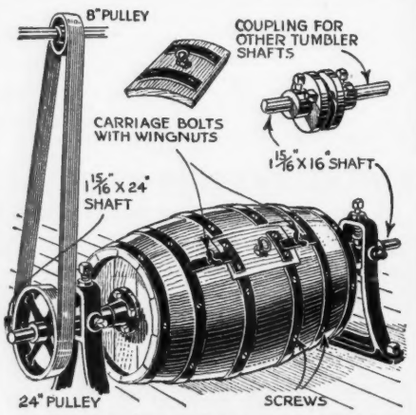
Better Shop Methods

Cleaning and Buffing Tumbler Made from Strong Barrel

AFTER several years of satisfactory experience with a tumbler made from a wooden beer barrel, I have found it to be quite as durable as the more elaborate outfits costing two or three times as much. A large barrel can be used, although I prefer the half-barrel size. If more capacity is required, another barrel can be coupled to the same shaft.

A hole 12 in. square is made in the side of the barrel by drilling four holes and cutting out the wood with a keyhole saw. The section cut out is used for a cover. Before the cutting is done, however, the hoops should be reinforced with wood screws or lagscrews through holes previously drilled for this purpose.

For the door clamps a piece of ½ by 2 in. iron is used. A 13/16-in. hole is



After being fitted with a door, the barrel is mounted between two inverted shaft hangers

drilled in the center of each clamp to take a carriage bolt, which passes through the barrel about 3 in. from the edge of the opening. Each bolt is provided with a wingnut for clamping the door in place.

Each end of the barrel is fitted with a flanged coupling provided with journal ends. These should be centered carefully and lined up in relation to each other. Two plain shaft hangers inverted on the floor serve as bearings. A 24-in. pulley on the tumbler shaft and about an 8-in. pulley on the line shaft give a suitable speed.

Aluminum or brass castings, as a rule, will tumble to a nice finish without using any polishing agent. For sheet-metal stampings the small slugs and scrap punchings may be placed in the barrel to speed up the work and produce a better finish. For a superior finish use dry sawdust or leather scraps.—F. J. WILHELM.

Lathe Pan for Brass Chips

MOST lathes have two pans for chips, one for iron and one for brass. If your turning is mainly iron, the trouble of changing the large pans can be saved by making a small pan that just fits in the opening in the bed under the chuck. The majority of lathes have a flange at the bottom of the bed that will hold the pan. It is best to provide handles with which to lift it out.—G. F. S.

U.S. PATENTS

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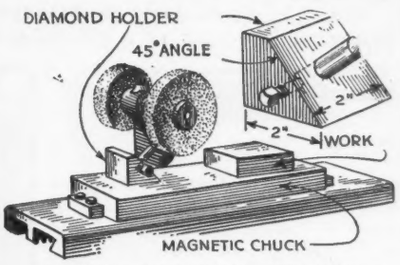
Better Shop Methods

Special Diamond Holder for Redressing Emery Wheels

WHEN truing a surface grinder wheel with many diamond holders I have seen, it is necessary to raise the wheel high enough to allow the diamond to pass under it. After the wheel is true, it has to be reset to its former position.

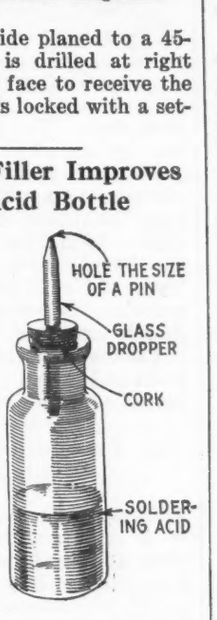
To avoid this resetting, the holder shown may be used. It is simply a cast-iron block with one side planed to a 45-deg. angle. A hole is drilled at right angles to the angular face to receive the diamond tool, which is locked with a set-screw.—H. W.



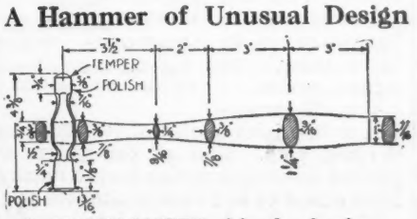
Through the use of this diamond holder a wheel can be redressed without being raised

Fountain-Pen Filler Improves Soldering Acid Bottle

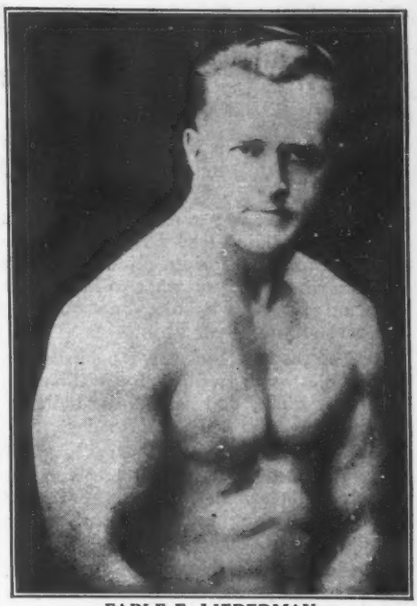
IN 25 years' experience I have found nothing better than acid for general soldering, but I have adopted a better method of handling it than is used ordinarily. I took the glass from an old fountain-pen filler and slowly revolved the point in a gas flame until it was nearly closed. Then I burned a hole through the cork of a wide-mouthed 2-oz. bottle and pushed the filler through. A new cork is needed about every six months. With the hole in the filler the right size, the acid does not run out if the bottle is tipped over, but as soon as the point is touched on the work, the acid comes out instantly.—ALLEN BRUNCK, Town Line, N. Y.



A Hammer of Unusual Design



A TOOLMAKER friend of mine recently made a hammer that so impressed me because of its design and "feel" that I copied it for the readers of POPULAR SCIENCE MONTHLY who like fine tools and take pride in artistic merit as well as general utility.—O. B.



EARLE E. LIEDERMAN
The Muscle Builder

What Is a Bohunk?

A BOHUNK is a man who knows the right thing to do and then deliberately does the opposite. Sometimes we call these fellows fools. Sometimes we use stronger words to describe them. We laugh at them. We pretend they are funny. But we never respect them.

And still—how many fellows are just plain BOHUNKS and never realize it? They are given a good, clean body to start with. They know that this body is one of the most delicately constructed organisms ever put together. Their common-sense teaches them that they must not abuse it—and then: they eat every blame thing they can lay their hands on just to satisfy their appetites. They go on committing sins against their flesh that even a dog would not do. They know that their bodies need exercise just as much as they need food. And still they permit themselves to grow soft and flabby, accumulating poisons, disease and every kind of germ imaginable.

THE WISE MAN

Come out of it, fellows. Don't be a plain dumb Dora. Don't you realize you can't keep this up? You're really not living at all. You only think you are. Cut out this foolishness and get busy. Drive those decaying tissues out of your body. Throw out your chest and give your lungs a treat with some good, pure oxygen. Harden up those soft, flabby arms of yours. Take those rolls of jelly off your body. Get some honest-to-goodness muscle. Find out what real health and strength mean. You'll realize then how foolish you've been to go without it. It's been yours right along for the asking.

A NEW MAN IN 90 DAYS

Come to me and let me help you. You can't do it alone. You may think you can, but you'll find you are wrong again. This is my job. I've been doing this very thing for 15 years and I know just how it can be done. I'm going to pack one full inch of healthy muscle onto those arms in just 30 days. I'm going to add two inches to your chest in the same length of time. Yes, but that's nothing. I haven't done a thing yet. Now come the real works. Just watch 'em grow. I'm going to broaden your shoulders and deepen your chest. I'm going to stretch out those lungs of yours that are now sticking together like pieces of fly paper. Every time you take a breath you will feel the old oxygen shooting through your blood and making your whole body tingle with new life. I'm going to put some real pep into that old backbone. I'm going to build up those muscles in and around your vital organs. You will feel the thrill of vitality throughout your entire system. And all I ask is 90 days. Sounds good—doesn't it? You're durn tootin' it's good. It's wonderful. And the best of it is—I guarantee all this. Do you doubt me? Come on, then, and make me prove it. That's the stuff. That's what I like. Are you with me? Let's go.

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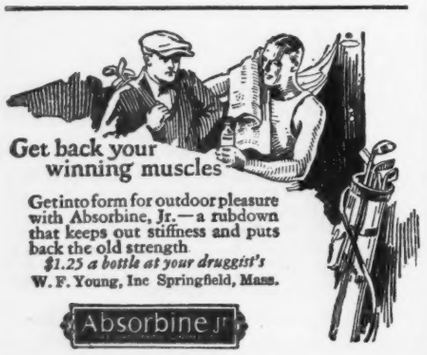

Get back your winning muscles

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$1.25 a bottle at your druggist's

W. F. Young, Inc Springfield, Mass.

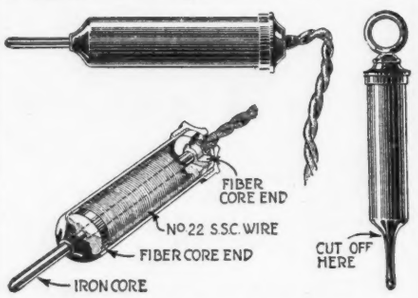
Absorbine Jr

Better Shop Methods

How to Make an Eye Magnet for Use in the Shop

IN SHOPS where many steel and iron castings are ground, hardly a day passes without some of the workmen getting particles of the metal in their eyes, no matter how stringent are the regulations in regard to wearing goggles. In our shop I have used the magnet described below successfully for several years in removing the offending particles.

A small hard rubber syringe of the type illustrated is bought at a five-and-ten-cent store. The piston is removed and the pipe cut off at the base as shown.



The magnet is made by winding fine wire around a nail and inserting it in a casing

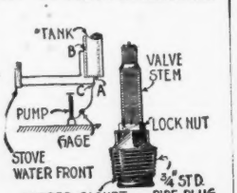
Fit a large nail into the hole thus made, allowing it to protrude an inch or more from the rubber casing. Make two core ends of ⅛-in. fiber to suit the nail. Wind the bobbin thus formed with several layers of No. 22 single silk-covered magnet wire. Solder the leads to a length of flexible lamp cord.

File the free end of the nail to a rounded point and polish. Hook it up to several dry cells and it is complete.—P. A. JUDD.

Air Pressure Used for Testing Water-Pipe Connections

FOR testing a piping job after the work is done and before turning on the water the plug illustrated is useful. It is intended especially for checking the work in such jobs as installing range boilers and hot-water systems.

An ordinary pipe plug is drilled 13/32 in. through the center. A valve stem from a discarded auto tube is inserted, the locknut making a sealed joint. The rubber surrounding the stem on the tube should be cut around the flange, so as to leave enough to make a gasket.



The plug and diagram of the connections

Use a T connection at the joint marked *C* for attaching the test plug. Shut off the system at point *A* and *B* by inserting in each union a blind gasket to be removed after the test.

The plug then is screwed into any side outlet in the system and pressure is applied with a hand pump to which a gage is attached. From 50 to 60 pounds is sufficient to indicate any leaky joints. The plug is replaced after the test with a regular pipe plug.

$3.50 cash

RADIO Storage "B" Battery

12 Cells 24 Volts *Lasts Indefinitely—Pays for Itself*

Economy and performance unheard of before. Recharged at a negligible cost. Approved and listed as Standard by leading Radio Authorities, including Pop. Radio Laboratories, Fox Sci. Inst. Standards, Radio News Lab., Lefax, Inc., and other important institutions. Equipped with *Solid Rubber Case,* an insurance against acid and leakage. Extra heavy glass jars. Heavy rugged plates. Order yours **today!**

SEND NO MONEY Just state number of batteries wanted and we will ship day order is received. **Extra Offer:** 4 batteries in series (96 volts), $13. Pay expressman after examining batteries. 5 per cent discount for cash with order. Mail your order **now!**

WORLD BATTERY COMPANY
1219 So. Wabash Ave., Dept. 80, Chicago, Ill.
Makers of the Famous World Radio "A" Storage Battery
Prices: 6-volt, 100 Amp. $12.50; 120 Amp. $14.50; 140 Amp. $16.00. All equipped with Solid Rubber Case.

World FOR RADIO STORAGE BATTERIES

KDKA - WEAF - WGN - WJS - KFO - KGO - KFAE - WJY - KDN

Saw Books FREE

"Saws in the Shop," "Saw Sense," "Saws on the Farm."

Just send us your name and address and say which of these helpful books you want and we will send it FREE. Write NOW

E. C. ATKINS & CO., Inc.
Dept. D-20 Indianapolis, Ind.

BEAUTIFY YOUR CAR!

Promanco

Auto Frames all the rage! Adjustable. Add 100% to appearance of any car. Order today. Postpaid $3.00. Money returned if not satisfied. **Distributors.** Fortune right men! Demand spreading like wildfire! Exclusive territory now. Write dept. 25.

PRODUCTS MANUFACTURING CORP.
168 DARTMOUTH ST., BOSTON, MASS.

Saves Gallons of Gas

Any reader can prove on his own car, Ford or any make, how easy it is to increase gasoline mileage 50% and get rid of carbon, by writing Ed. Naylor, 481 Produce Ex. Bldg., Kansas City, Mo. He has perfected an amazing invention which any one can put on car in three minutes without boring or trouble. Doubles power on hills. He wants agents and is willing to mail sample at his own risk. Send him your name today.

fishermen get this book

Fishing facts and hints. Tells how to compete in our annual $2,000 Fish-Photo contest. A postal gets it FREE!

SOUTH BEND BAIT COMPANY
14581 High Street South Bend, Ind.

Clear Your Skin!

Your Skin Can Be Quickly Cleared of Pimples, Blackheads, Acne Eruptions on the face or body, Barbers Itch, Eczema, Enlarged Pores and Oily or Shiny Skin.

FREE Write today for my **FREE BOOKLET,** "A CLEAR-TONE SKIN,"—telling how I cured myself after being afflicted 15 years.

E. S. GIVENS, 153 Chemical Bldg., Kansas City, Mo.

No Joke To Be Deaf

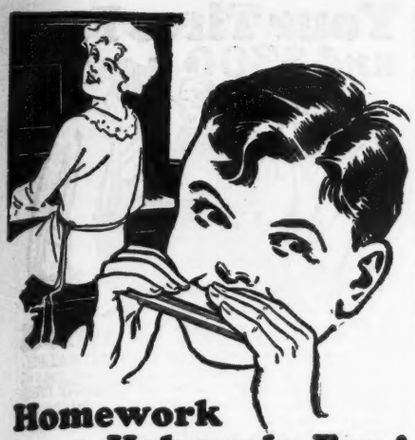
—Every Deaf Person Knows That. I make myself hear after being deaf for 25 years with my Artificial Ear Drums. I wear them day and night. They are perfectly comfortable. No one sees them. They stop head noises. Write me and I will tell you a true story, how I became deaf and how I make you hear. Address. Geo. P. Way

Artificial Ear Drum Co., Inc.
86 Hoffman Bldg., 2539 Woodward Ave., Detroit, Mich

A SERVICE FOR YOU

In Buying Radio & Tool Equipment

For list of tested and approved products write to the Popular Science Institute of Standards. See page 21.



Homework on a Hohner is Fun!

Music plays an important part in the education of the boy or girl; and today the harmonica is playing an important part in musical education.

Anybody can quickly learn to play a Hohner Harmonica with the aid of the Free Instruction Book. There are no long hours of study and practice—just a few minutes a day, when you feel the desire, and you will soon be playing popular, classical and jazz selections.

Homework on a Hohner is *fun*. It teaches accuracy, rhythm and expression, the basis of a musical education. Get a Hohner today and ask for the Free Book. If your dealer is out of copies, write M. Hohner, Dept. 182 New York City.

Leading dealers everywhere sell Hohner Harmonicas—50¢ up.

HOHNER HARMONICAS

Positively identified by the Ace trade mark stamped on the frame. A few strokes through the discs will sharpen the dullest knife. Try your hardware dealer first or send $1.00 direct to

ACE HARDWARE MFG. CORP.
Philadelphia Chicago San Francisco

Best for Reflex

and Crystal Sets

FRESHMAN

Double Adjustable Crystal Detector

No more searching for the sensitive spot. —Merely turn the knob as you would a dial.

For base or panel mounting, complete with Freshman Super-Crystal **$1.50**

At your dealer's, otherwise send purchase price and you will be supplied postpaid.

CHAS. FRESHMAN CO., Inc.
240 West 40th St., New York

Those Who Carry Our Mail in the Air

(Continued from page 32)

this is in use the dense clouds will be robbed of their terror."

Many of the air pilots agree that the danger stretch of the transcontinental route is not in the Rocky Mountains, but along the airway between Mineola, L. I., and Cleveland, Ohio. For much of the time the Alleghanies are covered with fog blankets, and there is one span where scarcely a landing-field is available for 200 miles.

Dense snow and sleet storms are as serious as fogs. The pilots agree that extreme cold does not slow down the service, because the men are clothed for protection from low temperatures, and each plane is equipped with cockpit heaters. They tell me, however, that it is far from pleasant to spend eight hours battling a blizzard, through blinding snow, with a bitter wind screaming around them, and with no ground lights visible for their guidance.

One of the recent developments in the service is snowshoe equipment for the mail-planes, for use in forced landings. Rain also brings disadvantages, for the high speed of the plane causes each drop that strikes the pilot's cheek to bite fiercely and painfully.

LET Pilot H. G. Boonstra tell of his experience with a head wind. In piloting postal plane No. 357 from Cheyenne to Federal, in Wyoming, Boonstra received liberal education as to what the wind can do to a flyer.

"The distance is 18 miles," Boonstra says. "On the night before Christmas, 1924, I spent 73 minutes in covering this stretch. Try as I might, I could go no faster. Believe me, it was some wind! The thing figured out that I was driving the plane at a speed of 100 miles an hour, that the wind was driving me back 86 miles an hour, and that my actual progress was at the rate of only 14 miles an hour."

Boonstra is a hero to the people of Pinedale, Wyo. Pinedale is an isolated community, 105 miles north of Rock Springs, cut off from the outside world for the greater part of each winter. Some time ago a rancher was dying in this remote settlement and no medical aid was available. In this emergency Boonstra ferried Dr. E. S. Lauzer, a Rock Springs surgeon, to the bedside and was instrumental in saving the rancher's life.

Some time after the Pinedale incident, Boonstra was lost on his regular run and grave fears were entertained for his safety. Recalling his trip to Pinedale, every man in the entire countryside dropped his work and searched for Boonstra until he was found. They tell me that any man in the air-mail service of the Rockies can have anything he wants at the hands of the citizens.

In any narrative of the transcontinental airway, Pilot Paul Scott enters at frequent intervals. Before his experience in the Utah Mountains, already told, Scott was flying eastward toward Salt Lake when his radiator exploded. The plane took fire, but Scott succeeded in

(Continued on page 126)

Applying the new tread—the inventor, Emil Nestler, rubber expert and engineer, demonstrates one of the seven simple steps in this amazing process.

Be President of your Own Company

THE discovery of the first known method of joining new rubber to old by actual fusing or welding is your opportunity to own a highly profitable business in your own name. Millions of pneumatic tires—car, truck, balloons—now junked merely because part of the rubber has worn off the treads, can now be kept in service. Car owners can cut tire costs in half.

NESTLER Rubber Fusing Process

The Modern Method of Tire Servicing

Think of what this service would mean right in your community! Not an experiment. Process has been carefully perfected during past seven years, and has been endorsed by the leading authorities. Thousands of tires already Nestlerized (retreaded by Nestler Process) have demonstrated soundness of method in actual road service.

Make Guaranteed Tire Repairs. Your Nestler Equipment will enable you to offer a **Guaranteed Tire Repair Service,** too. The Nestler Method is faster, less costly and more profitable than old-fashioned methods and in addition produces a positive fusion of new and old rubber that you can guarantee. The Nestler Process is a revolutionary advance in the art of tire servicing.

No experience necessary to become an expert in this line. Process is amazingly simple. We teach you free when you buy your equipment. Profit possibilities are unlimited. Small capital required. Right **Now** we can make you a **Special** Proposition that assures **Earnings From The First Week** —just like entering a going business.

This book tells all about the Nestler Rubber Fusing Process and describes the methods you can employ to build up a prosperous business in your own community. Send for it today.

Get the facts. No obligation. Fullest investigation invited. Just write for the booklet. Ask for the Special Proposition. Limited and exclusive territories now being assigned. To get the territory of your choice, write **Now!** This is an opportunity of a lifetime and you should not miss it.

Nestler Rubber Fusing Co., Inc.
Dept. P. S.
245 West 55th St.,
NEW YORK CITY

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 21.

The transfer of another clubman is here recorded

Some smokers appear to have begun their pipe-smoking with Edgeworth and have stuck to it ever since.

Others, of more adventurous or more inquiring nature, have evidently started out to "try 'em all" before signing up with any one brand.

Mr. Schroeder's enthusiasm for his final favorite is evidently based on a pretty broad knowledge of the field.

Read his letter:

Messrs. Larus & Bro. Co.,
21st & Main Sts.,
Richmond, Virginia.

Gentlemen:

I have been reading with a great deal of interest the advertising you have been running in the Saturday Evening Post, particularly the issue in which the letter from Mr. K. F. Chapman stated that he was a member of the "Tried-'em-All Club."

It may be of interest to you to know that I was a member of this same club up to about four years ago, when I resigned and joined the "Edgeworth Club." I don't mind telling you that I was employed in one of the largest tobacco companies in the country for about twelve years, and my loyalty to this company compelled me to smoke the brands of pipe tobacco which they manufactured; but try as I would, I could not become a steady pipe smoker. After I left this company several years ago, I tried Edgeworth Ready-Rubbed Tobacco, and I have been smoking it ever since.

Now, I have a life membership in the "Edgeworth Club" and take it from me it is "some club."

Respectfully yours.
E. A. Schroeder.

Let us send you free samples of Edgeworth so that you may put it to the pipe test. If you like the samples, you'll like Edgeworth wherever and whenever you buy it, for it never changes in quality. Write your name and address to Larus & Brother Company, 10E South 21st Street, Richmond, Va.

Edgeworth is sold in various sizes to suit the needs and means of all purchasers. Both Edgeworth Plug Slice and Edgeworth Ready-Rubbed are packed in small, pocket-size packages, in handsome humidors holding a pound, and also in several handy in-between sizes.

We'll be grateful for the name and address of your tobacco dealer, too, if you care to add them.

To Retail Tobacco Merchants: If your jobber cannot supply you with Edgeworth, Larus & Brother Company will gladly send you prepaid by parcel post a one- or two-dozen carton of any size of Edgeworth Plug Slice or Edgeworth Ready-Rubbed for the same price you would pay the jobber.

Those Who Carry Our Mail in the Air

(*Continued from page 125*)

landing. Ship and mail were completely consumed—and there is something impressive in the fact that this is the only case in which air mail has been destroyed.

When night flying was attempted many people shook their heads and predicted a heavy death list for the daring pilots. These forecasts have proved without foundation. The first fatality occurred after six months of operation, when Clarence Gilbert was killed near DeKalb, Ill. Evidence indicated that his motor had died when there was no landing-field within range. It appeared that the pilot jumped and that his parachute was caught by the fierce wind and torn from its ropes, causing Gilbert to be dashed to his death.

Gilbert's death was notable for more reasons than one. Not only was it the first fatality in 1,200,000 miles of night flying, but it afforded a fine example of the sense of duty actuating the men of the postal service. In his perilous position Gilbert took time before jumping to "pull" the electric switches on his plane. This presence of mind prevented the explosion of 90 gallons of gasoline carried in his tanks, and saved the plane and its cargo of mail from destruction by flames.

The great factor of safety for the mail pilot is his parachute, always strapped to his body, and ready for instant use in case of emergency.

Another safety device carried by night-flying planes is a brace of flares stowed in a recess in the bottom of the fuselage. These are for use in forced landings away from the emergency fields. By lighting and dropping one or both flares, the pilot may produce brilliant illumination for half a mile in every direction, enabling him to select the smoothest spot for his landing. The flares float on parachutes, and remain lighted for 10 minutes.

FRANK YAGER used these flares to good advantage on a westbound trip from Omaha to North Platte. About midnight he ran into a severe storm. By the light of his floating flares he was enabled to land with but slight injuries, although his plane was demolished.

A by-product of the air-mail service is a machine known as the puddle jumper, which patrols the lighting system of the night-flying airway. These planes have 33-foot wings, seven feet four inches in width. They are able to land at low speed, which makes it possible for the pilot to drop to earth in small fields. The machines have big flat wheels, known as "puppy feet," for which the soft mud of a rain-soaked field has no terrors.

The puddle jumpers go where other planes would fail. Their all-metal propellers serve as weed cutters, making it safe to land and take off in dense growth that would chew up the wooden parts of the mail-plane propellers. On this type of plane is an electrician whose sole job is to see that the lighting system of the night airway is kept in perfect condition. He is responsible for the proper working of the five beacons of 500,000,000 candle-

(*Continued on page 127*)

Your Tires Free and $300 a month

Agent Users Wanted

SEE how easy it is with the MASTER SALESMAN KIT, which I send Free, to make $10 to $15 a day in your spare time showing MELLINGER TIRES at BIG SAVING to car owners. This powerful, handmade, oversize, non-skid Cord is guaranteed by Bond for mileage half way around the world.

The Mellinger Plan starts you in business, all or part time; no capital or experience needed. Tires shipped prepaid on approval. Lowest wholesale prices in America.

FREE If you will boost MELLINGER TIRES, I have a surprising offer that will give you a set of tires Free. Also the Master Salesman Kit with sample sections. Be first to get my free offer, amazing confidential wholesale prices and big free book. Simply send name today to nearest address. S. L. MELLINGER, Pres.

MELLINGER TIRE & RUBBER CO.
Philadelphia, Pa. Dept. 1929, Kansas City, Mo.

ZIP-ZIP

THOUSANDS of boys are made happy with this wonderful Zip-Zip shooter, something every boy wants and never gets tired of. Zip-Zip shooter is scientifically and practically made; boys, if you like hunting and outdoor sports, get a Zip-Zip shooter with plenty of pep and force and learn that quick and sure aim. If your dealer happens not to have them, order from us. Zip-Zip shooter complete 35c or three for $1.00; send stamps, coin or money order.

AUTOMATIC RUBBER CO., Dept. 22, COLUMBIA, S. C.

Agents Make $200 to $500.00 Per Month

INSTANT WELD.
Welds Rubber Instantly. Better, quicker, and easier than vulcanizing. **ONCE ON—ALWAYS ON.** No Heat or Cement required. Repairs blow outs, punctures, rubber boots, shoes, etc. Guaranteed to outwear article repaired.

Agents, Salesmen and Distributors Wanted.

TOURIST PRIDE MANUFACTURING CO.
Desk 45E MINNEAPOLIS, MINN.

Tool Cases

for Machinists, Carpenters and Tool Makers; none better; thirty styles. Quartered oak and metal covered. Ask for booklet.

"Built for Service"
The Pilliod Lumber Co., Swanton, Ohi

BURN YOUR NAME ON TOOLS WITH ARKOGRAF

Protect your tools from theft. Write any name, engrave any design on tools and metal with electricity like writing on paper with pen or pencil. Complete outfit $3.50, prepaid anywhere. Interesting descriptive circulars free. Write to-day. Agents wanted.

Arkograf Pen Co., 1171-A East Stark St., Portland, Oregon

SEND FOR THE INTERNATIONAL CATALOG

Our net price list. Full line of auto bodies and accessories for Fords at *Wholesale Prices.* Save big money on bodies by buying Direct from Factory.

FOR FORD—Prices from $27.85 up. Factory to consumer direct—Pay only One Profit

International Body Works, 914 W. Ohio St., Dept. 8, Chicago, Ill.

MOVIES IN YOUR HOME

Our marvellous, practical MOVIE MACHINES sell as low as $3.75 postpaid and use same size film as big theatres. We also have wonderful films at lowest prices—with a new film exchange service. DON'T MISS THIS! *Write NOW for free catalogue*

PARAMOUNT MFG. CO.
Dept. PS 7 Boston, Mass.

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Those Who Carry Our Mail in the Air

(*Continued from page 126*)

power each, the 33 beacons of 5,000,000 candlepower, and the 360 flashing lights of 5000 candlepower, lining the route from Cleveland to Rock Springs, Wyo.

One puddle jumper works between Cleveland and Chicago, one between Chicago and Des Moines, one between Des Moines and Grand Island, Neb., and one between Grand Island and Rock Springs. The electrician carries a typewriter, and when he spots trouble he types a memorandum instructing the caretaker to look after it. Where there is no caretaker, the electrician lands and fixes the lights himself.

Radio stations along the transcontinental airway serve as dispatching stations and furnish quick communication in cases of forced landing. These stations also give advance weather reports and convey orders to the various depots. Weather information and threats of possible storms ahead are signaled to pilots by caretakers at frequent intervals.

In the air-mail service much of the flying is done by seasoned veterans. In a recent compilation, William C. Hopson, of Omaha, held the record of performance, with more than 2236 hours of flying to his credit, and a distance of 221,876 miles. James H. Knight, of Omaha-Cheyenne, had flown 2311 hours, covering a mileage of 211,095. E. Hamilton Lee's record stood at 2387 hours and 201,205 miles.

IN THE wilds of Alaska the Post Office Department has demonstrated the value of air-mail service for inaccessible areas. A series of flights between Fairbanks and McGrath proved beyond doubt that the airplane is the mail messenger of the future for rugged and isolated regions.

Dog sleds require 35 days for the round trip of 742 miles. Pilot Carl B. Eielson made repeated round trips in slightly more than six hours of actual flying time.

In one of these journeys the pilot became lost and was overtaken by pitch darkness, in the heart of the mountains, with not even a star for guidance. In this plight he could not land. The only thing to do was to wander around in midair. After more than an hour of perilous flying he picked up the Fairbanks beacon light and made a safe landing.

The mail-planes carry a wide variety of cargo, from fresh California dahlias for the New York dahlia show to the latest New York styles in dresses for a Los Angeles fashion show. Bankers use the mail service freely, because of the saving in interest. By airplane the time consumed in transmitting funds is reduced three days, with an estimated annual interest saving of thousands of dollars.

International mails are speeded by the air-mail service. As much as two weeks may be saved in the transmission of European mails for Australia and the Orient, formerly sent through the Suez Canal.

The air mail is still in its infancy. Its service to the public is being constantly extended. That it is proving such a distinct success is due largely to devoted, courageous fliers who speed over vast stretches of the country every hour.

$542.00 Earned IN ONE MONTH

A New Business—Big Business

A Business to Enthuse Over — The "Ideal" Lawn Mower Sharpener

A wonderful invention that sharpens lawn mowers scientifically—quickly—perfectly; does the work as nothing else can.

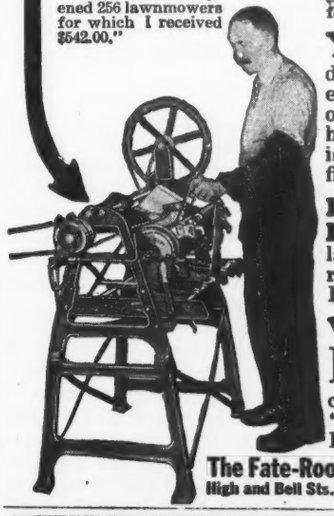
FRED C. MILKERT OF ROSELLE, ILL., WRITES: "The Ideal Lawn Mower Sharpener put me in business, starting in the basement of my home and forcing me now for the third time to move into bigger quarters. Today the dream of my life — a shop of my own — is realized. With a machine like yours and a little hustle any man can have a business of his own and be independent."

D. H. NOAKES, MILFORD, OHIO, WRITES: "Several years ago I started sharpening mowers in a 10 x 10 shed. Today I own a store of my own on Main Ave., No. 212, valued at $8,000.00. The 'Ideal' Grinder did it all."

FRED MILKERT, Roselle, Ill. writes: "Last June I sharpened 256 lawnmowers for which I received $542.00."

W. F. KENDT, BUFFALO, writes: I sharpened 994 lawnmowers last season, and the receipts were nearly $2100.00 which is not bad for a side line."

ZENO BRANDON, MIDDLETOWN, OHIO, writes: "I made $820.70 in 55 days with my 'Ideal.' Have made as high as $38.70 in one day."



You Start Now No town too small. Lawn mowers are dull—owners don't know where to get them sharpened. Mowing the lawn dreaded because of dull or improperly sharpened mower. Lawn mowing healthful, invigorating and pleasant when Mower is "Ideally" sharpened. You do the work scientifically—you are in big demand.

Lawn Mowers Sharpened to Razor Edge— People glad—owners delight in mowing lawn with mower sharpened on an "Ideal." Mower runs light—click-click-click and the grass is cut. Build permanent business for yourself. Start now!

WRITE TODAY Free —Detailed illustrated catalog and booklet "Let George Say It." Write today.

The Fate-Root-Heath Co.
High and Bell Sts., Plymouth, O.

USE THIS—MAIL IT TODAY
The Fate-Root-Heath Company
High and Bell Sts., Plymouth, O.
Please mail at once free Illustrated Catalog and booklet "Let George Say It."
Name .....
Address .....

MAKE MONEY AT HOME

You can earn good money at home in your spare time making show cards for us. No canvassing or soliciting. We show you how by our new simple instructograph method. We supply both men and women with work at home, no matter where you live, and pay you cash for all work completed each week. Full particulars and booklet free. Write today.

AMERICAN SHOW CARD SYSTEM LIMITED
206 Adams Building, Toronto, Canada

BLANK CARTRIDGE PISTOL
Protection against Burglars, Tramps, & Dogs

PRICES 50c. $1.00 POSTPAID

Well made and effective; modelled on latest type of Revolver; appearance alone is enough to scare a burglar. When loaded it may be as effective as a real revolver without danger to life. It takes standard .22 Cal. Blank Cartridges obtainable everywhere. Price 50c. Superior quality $1.00 Postpaid. Blank Cartridges, by express, 50c per 100.
Johnson Smith & Co., Dept. 346, Racine, Wis.

You'll Like It

Right from the Start

Marvelous new Indian Prince—the Personal Motor—goes 90 to 100 miles on a gallon. Operates at less than 1-3c per mile. Light—Safe—Clean. You learn to ride it in 5 minutes. Costs less than any other high-grade machine. Write today for illustrated booklet telling all about this new Indian Prince—the Personal Motor—and how easily you can buy it.

Indian Motocycle Co.
Dept. H-5, Springfield, Mass.

LEARN RADIO

Become a big-pay man in the greatest industry of all time. Quickly, easily and right at home, you can fit yourself for highest salary positions, or you can cash in on your spare time. The call is urgent for mechanics, operators, designers, inspectors. Unlimited, fascinating opportunities on land or sea

I WILL TRAIN YOU AT HOME TO BE A RADIO EXPERT

Under my practical, easy to understand, instruction—you qualify in an amazingly short time. No previous experience is necessary. Every branch of radio becomes an open book to you. You learn how to design, construct, operate, repair, maintain and sell all forms of Radio apparatus. My methods are the latest and most modern in existence.

FREE Wonderful home construction tube receiving set of the latest design. Write Today "Radio Facts" FREE

R. G. Mohaupt, Radio Engineer, RADIO ASSOCIATION OF AMERICA, Dept. 45, 4513 Ravenswood Ave., CHICAGO

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 21.

250,000 MECHANICS USE SNAP-ONS

Look for the name "Snap-On" on each handle and socket—without it no wrench is a genuine Snap-On

They'll tell you there's a Snap-On Wrench Combination for fast work on every nut—whether out in the open, around a corner or in the deepest and hardest-to-reach place.

They'll testify to the quality of Snap-Ons, as well as to the liberality with which the Snap-On guarantee is maintained.

Snap-On Wrenches are the perfected maintenance tools of this day and age. Get acquainted with them now.

Selected Sets for Car Owners

There's a small set especially selected by Snap-On engineers for your particular car. All the wrenches you need—none you don't need—and at a price you'll say is trifling compared to what they'll do. Ask to see it.

Ⓘ Snap-on
INTERCHANGEABLE
Socket Wrenches
SNAP-ON WRENCH CO., MFRS.
Milwaukee, Wisconsin

Motor Tool Specialty Co.
Distributors 14 E. Jackson Blvd., Chicago
Send me particulars. My address is—

If You Were Trapped in a Burning Building

(*Continued from page 34*)

extinguishers charged with tetrachloride.

"We worked there for three hours and a half before we could be sure the fire was out and all the time the submarine was three-fourths submerged—likely to sink at any moment."

Ship fires on city water-fronts frequently defy the efforts of fireboats and firemen until the arrival of a squad in smoke helmets makes it possible to penetrate the dense smoke and carry hose lines down to the blaze.

The Baltimore rescue company recently succeeded in extinguishing a fire in the bilge of the steamship *Florida* after suffocating smoke had driven the fire companies back.

IN THE disastrous Equitable Building fire in New York some years ago a bank employee trapped in a steel-lined chamber on the lower floor of the building was rescued by firemen who sawed through the steel window bars. An hour and 15 minutes was consumed in the task, which today could be done in a minute or two with an acetylene torch.

Nor is it only at fires that the scientific equipment of the rescue squad is found useful. In cave-ins on construction jobs, building collapses, and similar accidents the apparatus of the rescue firemen has saved many lives. Only a few weeks ago several people pinned under the wreck of an elevator in an office building in New York were released when the rescue squad cut the counterweights into half-ton chunks with the acetylene torch so that they could be removed. When the torch is used, by the way, a fire-extinguisher is always kept at hand.

Pulmotors of rescue companies frequently are employed in administering artificial respiration in cases of drowning and asphyxiation, as well as in resuscitating persons overcome by smoke or fumes. A Detroit rescue company by the use of a pulmotor on an infant, apparently stillborn, was able to start respiration.

Some of the most effective devices employed by rescue squads are the inventions of firemen. There is, for example, a heavy claw tool of soft steel, which finds its use in opening burglar-proof locks that have a bar across the inside of the door. This device was developed by a New York fireman. Its handle curves toward the edge of the claw instead of toward the side, so that when a lock gives way the handle will not strike the fireman who is prying the door open.

IN A fire in an Eastern city some time ago a door shut on a hose line, shutting off the flow of water. A fireman who had witnessed the incident suggested that a wedge would have been useful in holding the door open, and, since that time, every man in the department has carried a wooden wedge in his pocket, and no hose line is carried over a threshold without first wedging the door open.

A fireman in another city made a hose roller to be used in hoisting a hose line to the roof of a building. This speeds up the work considerably.

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JUST OUT! Our new 1925, ninety-six page Radio Catalog including all the best and latest Kits, Parts and Accessories. Also our new 32 page bargain section—Write for your FREE copy today!

SAVE MONEY! We buy up manufacturers' jobber, and dealer surplus and bankrupt stocks—but only brand new fully guaranteed nationally advertised apparatus. Our enormous buying power permits us to pay spot cash and get rock-bottom prices—even way below manufacturer's costs. That's why our catalog is crammed with thousands of wonderful Radio Bargains.

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STUART'S PLAPAO-PADS are different from the truss, being mechanico-chemico applicators made **self-adhesive** purposely to hold the distended muscles securely in place. **No straps, buckles or spring attached**—cannot slip, so **cannot** chafe or press against the pubic bone. Thousands have successfully treated themselves at home without hindrance from work—most obstinate cases conquered. **Soft as velvet—easy to apply—inexpensive.** Awarded Gold Medal and Grand Prix. Process of recovery is natural, so afterwards no further use for trusses. We prove it by sending Trial of Plapao absolutely FREE. Write name on Coupon and send TODAY.

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Something new! Premiere Finger Print Powder. Brings out invisible prints on many surfaces. Discovered by famous western criminologist and endorsed by police and detective departments. Complete instructions included—learn in one evening.

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The best stories are never written

HOW many times have you said, "This would make a wonderful short story"? But you didn't write it, and the inspiration was soon forgotten.

"Many a story banged off hot on my Corona in a front-line dugout would never have been written if I had waited to reach a spot of greater convenience." — *Louis R. Freeman, War Correspondent, Explorer, Traveler.*

* * * * *

The advantage of owning a Portable Corona is that you can write your best thoughts as they come to you, anywhere, any time—and that's the secret of successful writing! The newest Corona (Model Four) has the standard keyboard used in offices everywhere.

Corona Four costs only $60. Easy terms if desired. Look for Corona in your phone book or write Corona Typewriter Co., Inc., 112 Main St., Groton, N. Y.

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fits any Grid Leak mounting

FRESHMAN PLUNGER
TYPE VARIABLE GRID LEAK

was designed especially for the non-technical set owner who can replace in an instant the fixed grid leak with this new, efficient cartridge type Variable Grid Leak: without requiring the change of a single wire.

IS *At your dealer or by mail postpaid. Write for free catalogue.*

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240 W. 40th St. New York

In Buying Radio & Tool Equipment
Take the Advice of Engineers
Write to the Popular Science Institute of Standards for list of tested and approved products. See page 21.

Giant Engines Point to New Era in Transportation

(*Continued from page 25*)

hour, and its maximum speed 35 miles an hour.

One of the unique features of this great electric motive unit is that it carries its own converter station. This eliminates establishment of sub-stations along the route, a practice at present general in railroad electrification. Through a regenerative braking system the Ford locomotive will have the ability to develop electric energy at any speed from the maximum to practically a standstill.

The voltage adopted for the Detroit, Toledo & Ironton electrification is 22,000 volts, 25 cycles, alternating current, which is a trolley voltage twice as high as any previously used in this country.

There are other recent developments, however, in other than the electric field. I have already mentioned the announcement by Samuel M. Vauclain, of the Baldwin Locomotive Works. The Diesel-electric locomotive to which he referred is, he admits, an experiment, but it may develop into a satisfactory type for long hauls through stretches of country without water, or through sections where oil is the only easily available fuel.

The motor is of the inverted V-type with the crankcase above and the cylinders projecting down and to each side.

THIS Diesel locomotive, however, is not the only new development in this field. Reports from England tell us of a trial carried out with a Diesel locomotive on the London & Northeastern Railway. In Germany Diesel locomotives are being produced at Augsburg, and in Russia some 1200-horsepower engines are being supplied to the Russian State Railways.

Perhaps the most extraordinary of the new developments, in appearance at least, is the turbo-locomotive, which was described recently before the American Society of Mechanical Engineers. This, of course, is neither electric- nor Diesel-powered, but is driven by steam. Where other steam locomotives are of the reciprocating type, this new one is driven by turbines.

The advantages claimed for the new turbine locomotive are economy in fuel, low water consumption (the exhaust steam is condensed so that the water is used over and over), and smooth running due to the absence of reciprocating parts.

This locomotive is of 1000-horsepower, but a 2000-horsepower machine recently was completed by the Krupp works in Germany and studies and designs have already been made of locomotives of 5000 horsepower. The Krupp's locomotive, an odd-looking monster pictured on the cover of this issue, is reported to develop greatly increased hauling power with a saving of 20 per cent in coal over the ordinary reciprocating type.

It is possible that the turbo-locomotive may stem the tide that is flowing against steam locomotives, yet railroad men the world over recognize that the steam locomotive must be improved greatly or it must give way before the advance of other types.

Quickest *and* easiest way to fix punctures

So simple a boy can do it

Just clamp on a Patch-&-Heat Unit and light the fuel it contains. It's all ready to use anywhere, simple as a cartridge for a gun. No gasoline—no cement—even the raw rubber is cut to size. Will not loosen or come off. The repair is permanent because it's heat-vulcanized.

SHALER
5 MINUTE
VULCANIZER

Nearly three million motorists always carry a 5-Minute Vulcanizer because there are a great many times while on the road that you are compelled to repair a tube, even though you carry a spare. It's the easiest, quickest, surest method. Get a Shaler today. You may need it tomorrow.

Complete outfit — $1.50 — includes Vulcanizer and 12 Patch-&-Heat Units (6 round for punctures and 6 oblong for cuts). Extra Units cost only 75c a dozen. Slightly higher in Canada and far west. All auto accessory dealers sell it.

C. A. SHALER CO.
2101 Fourth Street Waupun, Wis.

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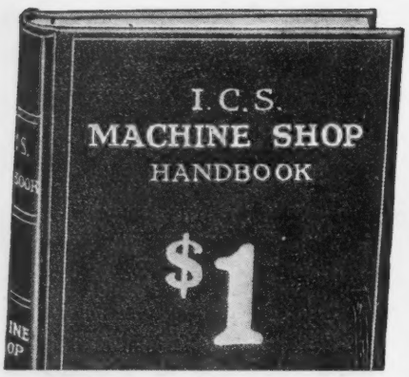

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THIS I. C. S. MACHINE SHOP HANDBOOK is a wonderful bargain at $1. Contains more common sense, practical information than any other book of its kind ever published. Will help you to get a better job and a bigger salary. Contents:

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I am enclosing _____, for which please send me the books I have checked below—

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☐ Patternmaking—420 pages	3.00
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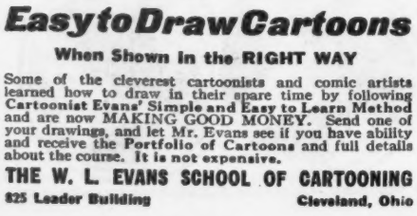


Easy to Draw Cartoons

When Shown in the RIGHT WAY

Some of the cleverest cartoonists and comic artists learned how to draw in their spare time by following **Cartoonist Evans' Simple and Easy to Learn Method** and are now MAKING GOOD MONEY. Send one of your drawings, and let Mr. Evans see if you have ability and receive the **Portfolio of Cartoons** and full details about the course. **It is not expensive.**

THE W. L. EVANS SCHOOL OF CARTOONING
825 Leader Building Cleveland, Ohio

Magic Cures Found in Sunshine

(Continued from page 37)

not have the treatment, and twice as many of the eggs hatched.

Doctor H. D. Goodale of Williamstown, Mass., has built the first sun porch equipped with mercury vapor lamps to provide his pedigreed chickens with ultra-violet light on cloudy days as well as bright ones.

Young chickens given baths of the light in an experiment by Dr. William T. Bovie of Harvard University and President C. C. Little of the University of Maine, weighed five times as much as others of the same age raised under natural sunlight filtered through window glass.

Manufacturers of automobiles have seized upon ultra-violet light to test body fabrics and finishes. A few hours of exposure of upholstery fabrics, top materials, and paints under ultra-violet rays were found equal to many months of natural weathering.

Pigments, the coloring matter in paint, are faded and discolored by the ultra-violet part of sunlight. One pigment, lithopone, much used in white paints, sometimes turns black after exposure to sunlight. Tests under ultra-violet light enable paint manufacturers, it is said, to tell in a few hours just how long their color schemes will remain attractive. The light has been used, also, to age painting materials and to dry varnish on automobiles.

Ultra-violet light penetrates water, so that it can be used to test materials, paint, and varnish, immersed in a bath. The effect of the light under varying weather conditions can thus be studied. Ultra-violet light streaming on a varnished surface in water, shows the effect of sunlight on a car left out of doors all night and covered with dew or rain.

VARIOUS experiments have shown that exposure to ultra-violet light stimulates plant growth. Several varieties of flowers and vegetables were found to grow twice as fast when artificial light was applied nine hours a day as under normal conditions. In Hawaii ultra-violet radiation was tried on sugar-cane, pineapples, and bananas. The fruits ripened more quickly when exposed to the rays, and it was estimated that sugar-cane could be harvested at the end of 12 months, were ultra-violet light used, instead of the 20 months normally required to reach maturity.

Indications point to a sunlight age, our crop production speeded up by floods of ultra-violet light on fields at night and in cloudy weather; vegetable markets and ice-boxes drenched with the light, making our foods more healthful; quartz windows in our homes and office buildings to take full advantage of ultra-violet light supplied us freely by the sun; and ultra-violet lamps indoors to use on dark days.

Winter will be as healthful as summer. We may even direct the light upon our bodies while we are sleeping. We may eat sunshine, drink it, and live in it continuously. Then we may look back with incredulous wonder at people who through centuries ignorantly failed to utilize fully this magical part of sunlight.

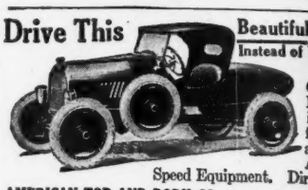
GET AIRPLANE-RADIO PLANS They show how to build Model Airplanes, Boats, Radio Sets, etc. **FREE**

Send 2 cents and addresses of two chums for copies now. **Big Model and Radio Catalog, post paid 5 cents.**

GLIDER AIRPLANE Flies 300 feet. Loops the loop spirals, just like a big airplane. Special, ready to fly, only..... **25c**

W. H. PHIPPS COMPANY
578-A Knickerbocker Avenue - - Brooklyn, N. Y.

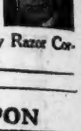
Drive This Beautiful Raceabout Instead of Your OLD FORD



Choice of Four Colors; Fiat or the Bullet Nose Radiator Shell. Send for 1925 Free Catalog of New Auto Acces', Bodies and Speed Equipment. Direct from Factory.

AMERICAN TOP AND BODY CO., Beech Street DELPHI, IND.

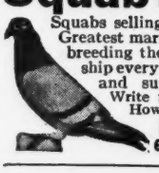
Why Buy Safety Razor Blades?



New Madden Safety Razor ends all shaving expense. Fast, easy, velvet shaves—new blades unnecessary. Wonder shaving edges that improve with use. Remarkable double-action razor instantly adjustable any angle. Delighted users everywhere. Money-saving shaver's outfit sent on **20 DAYS FREE TRIAL.** Don't miss it. For Free Booklet, write Desk 6, Madden Safety Razor Corporation, 1819 Broadway, New York, N. Y.

INSIST UPON AMSCO (S) AIR CONDENSERS VERNIER & VARIABLE

Squab Book FREE



Squabs selling at highest prices ever known. Greatest market for 20 years. Make money breeding them. Raised in one month. We ship everywhere our famous breeding stock and supplies. Established 24 years. Write now for big illustrated free book, How to Make Money Breeding Squabs.

PLYMOUTH ROCK SQUAB CO.
616 H St., Melrose Highlands, Mass.

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You can sell Premier Knife Sharpeners to housewives, restaurants, stores, etc. 9 out of 10 will buy. Sells for 50c. *Write today for attractive offer.* PREMIER MFG. CO. Dept. 9 Detroit, Mich.

LARGE PROFIT for you

10 DAYS FREE TRIAL — MONEY BACK IF NOT SATISFIED

THE NEW IMPROVED **INKOGRAPH** SELF FILLER GREATEST VALUE EVER OFFERED

The Perfect Writing Instrument **$1**

Writes with ink easy as a lead pencil. Won't skip, blot, scratch, leak or soil hands. Instantly endorses flow of ink improves handwriting.

Makes three carbon copies with original in ink. Guaranteed—Send No Money. Pay postman $1.50 plus postage.

INKOGRAPH, CO., Inc.
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Agents Wanted

A hard, round, smooth ball-like 14-kt. Gold Point.

"LIGHTING FIXTURES"

Ready to hang.
Direct from the manufacturer.
Completely wired including glassware.
Send for Catalogue No. 26
(*Just off the press*)
Special proposition to Dealers
ERIE FIXTURE SUPPLY CO.
Desk A, Erie, Pa.

MAKE MONEY SELL MADISON SHIRTS

Direct from our factory to wearer. Easily sold. Over one million satisfied wearers. No capital or experience required. Large steady income. Many earn $100. to $150. weekly. Territory now being allotted. *Write For Free Samples.*

MADISON SHIRT M'F'RS, 505 Broadway, New York

The Newest Contributions to Science

(*Continued from page 47*)

American Association for the Study of Goiter, however, this opinion is erroneous.

There is just as much goiter, he says, quoting other authorities, along the Atlantic Coast as there is in the Great Lakes region which was regarded as the 'goiter belt." Summarizing recent investigations, he adds that goiter now is believed to be an infectious disease. Only one type, endemic goiter, is due to deficiency of iodine. The use of iodine in the treatment of goiter has been found actually harmful in certain cases.

Says Fishes Can Smell

IT HAS been believed generally that fishes have no sense of smell, the reason being that smelling is supposed to consist of detecting gaseous substances in the air, a condition impossible to produce in the water. Now, though, Prof. Karl von Frisch, physiologist, of Breslau, Germany, offers the suggestion that fish actually do smell, backing his statement on a series of experiments he performed.

When Professor von Frisch placed food in the tank, the fishes found their way to it without delay. When the nose centers of the fish were rendered useless by an operation, however, they could no longer detect food from a distance, though they devoured it with normal appetite when they discovered it. He also ascertained that amphibians use the same organs for detecting food on land as in the water, thus seeming to indicate that their organs of smell worked just as well in water.

What Stammering Costs

STAMMERING costs this country $250,000,000 a year, according to Samuel Robbins, director of the Boston Stammerers' Institute, who bases his estimate on the fact that a half million stammerers earn an average of $10 a week less than those who have no impediment in their speech. This is the more deplorable, says Mr. Robbins, because usually stammering can be cured.

Stammerers, particularly children, says Mr. Robbins, should not associate with those who make fun of their defect, and those who are in daily contact with them should speak carefully and distinctly so that the sufferers may be inspired to emulate them. Mr. Robbins also makes the astonishing assertion that stammering is contagious, and that one stammering child, unless cured, can pass his habit along to his friends.

Million Animals Auto Victims

EVERY day of the automobile tourist season, now about to begin, more than 1,000,000 animals are killed by motorists on the 3,000,000 miles of motor highways of the United States, according to a compilation made by Dr. Dayton Stoner, of the University of Iowa.

In a single run of about 200 miles in Iowa, Doctor Dayton asserts he found 105 dead animals of 29 different species. In another trip of 632 miles he found 225 animals crushed to death.

pep
up your set with good tubes
"I DIDN'T think that tubes made such a difference—until I changed to MAGNATRONS." That's what one enthusiastic MAGNATRON user wrote us.
You, too, will be pleasantly surprised by the way that MAGNATRONS "pep" up a set and give it a new lease on life.
MAGNATRON DC-199, DC-201A, and DC-199 with large base sell for only $3 each at your dealer's.
CONNEWEY ELECTRIC LABS.
309 Fifth Ave., New York
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MAGNATRONS

7 TUBE LOUD SPEAKING
Only $29.50
GUARANTEED
LONG DISTANCE RADIO

MIRACO RADIO GETS 'EM COAST to COAST

"Have received more stations with my Miraco than I ever received with any other set costing $50 or $60 more," reports F. J. Brink, Grove, Okla. "More than pleased with my Miraco—have 125 stations on my log to date."—C. Gilland, Franklin, Texas. "Best set I ever used. Have heard London and California."—C. A. Henry, Vernbank Village, N. Y. "When you can't get a program with the Miraco you need not try any other set. Am getting all over U. S. with mine."—J. C. Brown, Albertville, Ala.

COAST TO COAST RECEPTION verified by Miraco users

NORTH DAKOTA HEARS CUBA
"Miraco has been working fine. Have heard from coast to coast. Also many stations in Canada and Cuba."—T. G. Anderson, Turtle Lake, N. D.

ILLINOIS HEARS N. Y. AND CALIFORNIA
"Believe Miraco best on market. Hear stations all over U. S. Also Cuba. Hear N. Y. and Cal. most every night."—Mrs. F. K. Prophet, Fawnee, Ill.

Reports like these from users in every state prove Miraco Tuned Radio Frequency sets—at rock-bottom prices—have efficiency of sets costing 3 times as much. Made by pioneer set builders. Factory-built, completely assembled, factory-tested, and guaranteed. Easy for beginners to operate. Order direct from this ad or MAIL COUPON BELOW—for special offer, latest bulletins, further testimony and proof that Radio offers no liner moderately priced receivers.

DEALERS AGENTS
The new Miraco proposition is a winner. Write.

only $14.35
MIRACO RADIO GETS 'EM COAST to COAST
FOR THIS GUARANTEED
LONG DISTANCE RADIO

MIDWEST RADIO CORPORATION
408-F, E. 8th Street, Cincinnati, Ohio
Send free literature, SPECIAL OFFER, and full particulars
[ ] USER [ ] AGENT [ ] DEALER
Name.....
Address.....

YOUR SHOP NEEDS THIS TOOL

.t's a mighty handy little tool for holding radio panels, boards, or metal pieces while drilling them. It is a portable vise that can be carried around the house or shop, for gluing, sawing and many other jobs. The Jorgensen "Steel Spindle" Hand Screw must not be confused with the ordinary wood spindle hand screw. The Jorgensen is rugged, and adjustable for angle clamping. Send for one, today, if your dealer cannot supply you, and save yourself a lot of time and trouble on the next job. Read the coupon!

Money Refunded if Unsatisfactory

ADJUSTABLE CLAMP CO.,
212 N. Jefferson St., Chicago
Please send items checked below:
☐ Ship by mail, postage prepaid, ONE No. 5-0 Jorgensen Hand Screw (Length 4 in., Jaw opening 2 in.) for which I enclose $1.00
☐ Ship by mail, postage prepaid, ONE No. O Jorgensen Hand Screw (Length 8 in., Jaw opening 4½ in.) for which I enclose $1.50.
☐ Send latest descriptive bulletins.
Money will be refunded if tools are unsatisfactory and are returned within 30 days.
Name.....
Address.....

WURLITZER
REG. U.S. PAT. OFF.

Girl of 13 Makes $75.00 a Week!

Alice Higgie, a 13-year old Chicago girl, made $75.00 a week in vaudeville last summer. Her musical act is constantly in demand for clubs, lodges, hotels, radio studios and private entertainments. For a 15 minute act she receives $15.00—*a dollar a minute!* Read what she says—"Playing a musical instrument is lots of fun. I wish everybody knew how easy it is and how quickly you can learn, especially with Wurlitzer instruments—they are so easy to play."—Alice Higgie.

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Learning to Play Made Easy Free

We now furnish free with every Wurlitzer instrument a Special Scholarship in a nationally famous school of music. This school has taught thousands to play by a special home study method. Many of its graduates are successful professional musicians. Whether you want to play for pleasure or for profit, choose your favorite instrument and send for this New Offer now! Use the coupon below.

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Illustrates and describes every known musical instrument—more than 3000 articles, many of them shown in full colors. All genuine Wurlitzer instruments—buy direct from Wurlitzer and save money. Special offers on complete outfits.

We also give you our Free Trial, Easy Payment plan and special Free Scholarship Offer. No obligation.

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Send me your Free Book on musical instruments. Also your Free Trial, Easy Payment plan and special Free Scholarship Offer. No obligation.

Name.....

Address.....

City..... State.....

Instrument.....

WURLITZER

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Here Are Correct Answers to Questions on Page 47

1. It jars the optic nerve and this stimulates it. The brain is in the habit of receiving from the optic nerve stimuli which it recognizes as light. Accordingly the stimulus caused by a jar of the nerve also impresses the brain as being a light stimulus, and we think we see a flashing light or a lot of them like moving stars.

2. The purpose of the flower is to attract insects. Most plants are green, so the flower is usually of another color in order that it may be more noticeable to the insect in the midst of green leaves.

3. Mainly a difference in the temperature at which they boil. Both of them are made by heating crude mineral oil in a still. The gasoline boils off first and is caught. The kerosene does not boil off until the temperature has been raised a good deal more.

4. Probably they are, though we cannot be sure. The growth of mountains is very slow. They are not pushed up suddenly in some grand cataclysm. They rise little by little, a few inches in a thousand years. We know that the Rocky Mountains are fairly new and that they have been rising quite recently, because they are so steep.

5. Because the pigment in the curtain of the eye may fade, in much the same way that dyes fade when they get old or have been exposed for a long time to the light.

6. Most electric wiring consists of at least two wires—one for the electrons to enter on, the other for them to return. If the insulation fails so that the two metallic wires touch, the electrons jump instantly from one to the other, sometimes so violently as to burn the wire.

7. The ones that float have had a very fine froth of air beaten into them just as you beat air into cream to make whipped cream. The soap really contains a lot of small air bubbles, far too small, of course, to be visible individually.

8. Because of the fact that water boils always at a certain temperature. The water in the bottom part of the double boiler cannot get any hotter than about 212 degrees. Accordingly the food cannot burn so long as any of the water is left.

9. Not in principle. In both of them an electric vibration is converted into sound by its effect on a small magnet in the telephone. But the detailed design of a radio head phone is not the same as that of an ordinary telephone receiver. The instruments are not interchangeable.

10. Worms like to lie on the damp ground. They do not do this at other times when the ground is dry because they do not like to become dry themselves.

11. Because any mass of matter takes this shape from its own attraction of gravity. If the earth were square and had corners that stuck out, the attraction of gravity of the rest of the earth would pull these corners down to the general level of the surface of a sphere, or close to it.

12. The heart tends to keep time with any strong rhythm. Ordinarily one's heart beats about 70 times a minute. The rhythm of a fast march is faster than this. So it makes your heart beat a little faster, the faster heartbeat improves the circulation of your blood, and that makes you feel more active.

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See people and objects miles away just like they were close; see Moon and Stars as never before. Opens over 3 ft. long, 5 sections, brass bound, powerful lenses. Useful and entertaining. "Could color of aeroplane 4 miles away."—Mrs. Yarbough. "Watch my boy arrive at school 2 miles away."—Mrs. Horn. "Read numbers on freight cars mile away, see mountains on moon."—A. C. Palmer. Thousands pleased.

Send No Money Write today; on arrival of Big 3 ft. Wonder Telescope with FREE Carrying Case and Strap pay Postman only $1.85 plus a few pennies postage. Satisfaction Guaranteed.

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INTERNATIONAL STUDIOS, Inc.
3601 Michigan Ave., Dept. 1365 Chicago, U.S.A.

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How to Wind Your Own Radio Coils

(Continued from page 76)

that is perfectly smooth and even, unless, by accident, a kink causes a short-circuited turn. If that happens, the coil is absolutely worthless for radio work. It will tune as broad as a barn door and the signal strength will be very poor.

This brings us to the matter of how to wind coils so that they will look so smooth and even that the casual observer will take them for factory-wound coils.

Like everything else, it is really simple when you know how. Of course, you must have good wire to start with, and it is much better to buy it on spools that are wound smoothly than on spools wound at random.

The next problem is how to wind the coil form without kinks. The simplest and best way, short of a winding machine, is the method shown in the illustration.

DRILL two small holes about one-fourth inch apart at the point where you want the winding to start, and pass the end of the wire through and back as shown in the tubing illustrated. Next, persuade some member of the family to hold the spool of wire with just sufficient pressure so that you can turn the spool and wind the wire on the coil form by turning the latter slowly and carefully. Naturally it is a slow process, but it turns out good-looking coils. With a little practice you will find that you can wind a coil of 50 turns or so in a very few minutes.

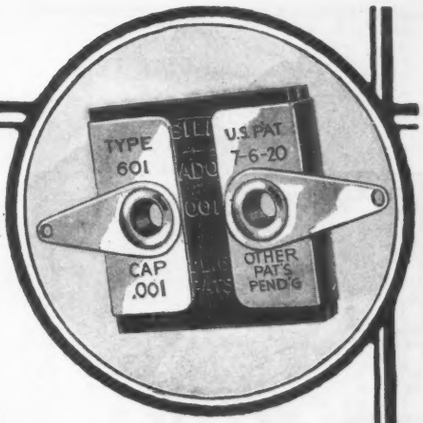
Of late, many radio writers are recommending double silk-covered wire instead of double cotton-covered wire. There is a good reason for this. Silk does not absorb moisture nearly as much as does cotton, and moisture in a coil will have nearly as bad an effect as a short-circuited turn of wire. Cotton insulation is practically as good as silk if it is absolutely dry, but, unfortunately, when there is much moisture in the air, the cotton-insulated coil promptly falls off in efficiency.

THE kind of insulation used has an influence on the number of turns of wire needed. Double silk insulation is thinner than the usual double cotton covering and, consequently, you will find it necessary to increase the number of turns of wire if you use cotton-covered when silk is specified. Similarly, you must decrease the number of turns if you wind coils with silk-covered wire when the receiver has been designed for cotton-covered.

Another important matter is that of using shellac, collodion, or other insulating varnish. The object of such treatment is to keep out the moisture and to prevent the wire from coming loose on the form.

So far as the radio fan is concerned, there is just one good rule and that is to stick to double silk-covered wire properly wound on the form, and avoid all forms of varnish or other "dope" for coils.

ANOTHER article by Mr. Senauke based on laboratory tests and containing hints that will aid you in efficient radio construction, will appear in next month's issue.



Only specialists can make *good* fixed condensers

THE small fixed condensers in your radio set are there to help you get clear reception. If these little condensers are not made most accurately the quality of reception you get—even though your set may be excellent in all other respects — will be greatly impaired.

You will find that nearly all sets made—in fact over 90% of them—are equipped with Dubilier Micadons. This is the name by which all Dubilier fixed condensers are known.

Be sure your set—whether you buy it or build it—is equipped with Micadons. They are made by *specialists*.

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Have the fun of doing it yourself and save half the cost

This book gives directions for making hundreds of electrical appliances and devices for the home, the shop and the garage. The simple directions and many drawings make the work easy.

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Steady work. No layoffs. Paid vacations. Common education sufficient.

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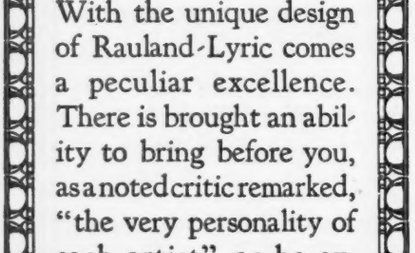
Do You Hear Each Instrument *Distinctly?*

With the unique design of Rauland-Lyric comes a peculiar excellence. There is brought an ability to bring before you, as a noted critic remarked, "the very personality of each artist", as he explores the resources of his instrument. Such a quality, indeed, as to render insignificant, in any radio set, the added cost of Rauland-Lyric Amplification.



Rauland-Lyric is a laboratory-grade audio transformer designed especially for music lovers. The price is nine dollars. Descriptive circular with amplification curve will be mailed on request. All-American Radio Corporation, 2668 Coyne St., Chicago.

Rauland-Lyric
AN
ALL-AMERICAN
TRADE MARK
TRANSFORMER
The Choice of Noted Music Critics

The Most Up-to-Date One-Tube Set

(*Continued from page 75*)

were bent up out of strip brass one-sixteenth inch thick and one-fourth inch wide. Do not make the brackets out of thick, wide brass or other metal, as it is desirable to have as little metal as possible near the coils. If you prefer woodwork to metalwork, make wooden brackets instead of the brass ones shown. They will be equally efficient.

Be sure to mount the socket *G* so that the filament terminals will be nearest the front panel *L*.

You now are ready to begin wiring and you can follow either the diagram shown in Fig. 2 or that shown in Fig. 4. Whichever one you use, be sure to mark over the line of each wire with a heavy pencil as soon as you connect the wire that it represents in the receiver. This method may save you much time in looking for trouble due to making wrong connections or leaving out a wire or two.

IT ALWAYS is well to get the filament wiring done first and in this receiver it is extremely simple. First run a wire from binding post No. 3 over to one terminal of switch *K*. From the other terminal of switch *K* run a wire to the nearest binding post of rheostat *H* and then connect the remaining terminal of rheostat *H* with the filament binding post of socket *G*, which is nearest condenser *E*. Do not worry over the fact that this terminal on the socket probably will be marked "+FIL." Plus and minus markings on filament terminals mean nothing anyway.

Next run a wire from binding post No. 2 over to the remaining filament terminal of socket *G*, and from this wire run a branch to the two ends of coils *A* and *B*, which are nearest to each other. Also connect binding posts Nos. 4 and 5 with binding post No. 2, and then run a branch from the wire connected with this post underneath the coils to the far end of coil *C* and another one to the rotary plate connection of condenser *D*. This completes the filament wiring and the grounded sides of all three circuits.

Now connect a wire from the remaining terminal of coil *A* with binding post No. 1, which completes the antenna circuit.

ONE side of the grid condenser *F* should be connected with the grid terminal of the socket *G*. In the receiver shown in the illustrations, a soldering lug was soldered to the grid condenser and the hole in the lug slipped over the binding-post screw of the socket, which makes as short a connection as it is possible to obtain. Complete the grid side of the secondary circuit by running a wire from the stationary plates of condenser *D* over to the terminal of the coil *B* nearest to coil *C*, and solder the wire also to the other terminal of grid condenser *F*.

Next connect a wire from binding post No. 6 to the lower lug of jack *J* and run a wire from the stationary plates of condenser *E* across to top lug of jack *J* to the plate terminal of socket *G*. Solder at both points. These last two wires are shown clearly in Fig. 7. Now connect the rotary plates of condenser *E* with the terminal of coil *C* that is nearest to coil *B*. This completes the wiring.

You now are ready to put the receiver into operation, assuming, of course, that you already have constructed the antenna.

FIRST connect the wire from the antenna to binding post No. 1. Run a wire from binding post No. 2 to the nearest water-pipe. Be sure to scrape the pipe bright with a knife or sandpaper and make the connection with the pipe with a ground clamp or, lacking this, wind 12 or 15 turns of bare wire as tightly as possible around the polished portion of the pipe.

Connect the A battery, either storage or dry cell, depending on the type of tube you are using, with binding posts Nos. 3 and 4, being sure to connect the minus terminal of the battery to binding post No. 3 and the positive terminal with binding post No. 4. Next connect the B battery—which should be of 45 volts for any of the standard tubes—with binding posts Nos. 5 and 6. Be sure that the positive terminal of the battery is connected with binding post No. 6.

Now snap the grid leak *I* into place in the clip on grid condenser *F*. Make sure that the rheostat *H* is turned all the way to the left, place the tube in the socket carefully, and plug the phones into jack *J*.

You now are all ready to tune in the broadcasting stations provided they are transmitting. First turn the dial on the shaft of condenser *D* around to 100 and do the same for the other dial. The dials, by the way, should be fastened to the shafts of the condensers with the 100 division at the top when the condenser plates are fully engaged with each other.

Snap on the filament switch *K* and turn the rheostat *H* slowly to the right until a click, accompanied by a slight hissing, is heard in the head phones. This click probably will be heard before the rheostat is turned more than halfway. There is a slight click when the rheostat first starts to turn and makes contact with the resistance wire, but the click indicating that the tube is oscillating is the one you should listen for.

WHEN the click is heard, you are ready to tune in. Turn dial *E* back toward *O* until the oscillations stop, then turn dial *D* slowly until you hear a signal. Readjust the rheostat *H* until the signal is coming in as loud as possible, but do not turn the rheostat farther than necessary to attain maximum signal strength, as such a procedure will cut down the life of the tube and use up the batteries needlessly.

(*Continued on page 135*)

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The Most Up-to-Date One-Tube Set

(*Continued from page 134*)

After the rheostat is set properly, turn the right-hand dial until the signal attains maximum loudness. You will find that when dial *E* is turned too far, the signal will be broken up suddenly by a clicking and rushing sound. This indicates tube oscillation and you should be sure to operate your receiver at a point below oscillation so as not to radiate and spoil your neighbor's reception.

If the receiver seems dead and lifeless and the weak signals you hear are decreased in strength when you turn dial *E*, the chances are that you have wound coil *C* in the wrong direction or reversed the connections to this coil. If you find that the coil is wound in the wrong direction, you can rewind it or reverse the connections.

There is just one other point to watch out for. Do not mistake the end of coil *C* nearest coil *B* for the end of coil *B*, and vice versa. Such a change in the connections will render the receiver absolutely inoperative.

Things I Have Learned About Your Car

(*Continued from page 72*)

Manufacturers advise not to drive a new car faster than from 20 to 25 miles an hour for the first 1000 miles. I'd say don't do it for the first 2000 miles. You'll have plenty of chance to try your car out after that, and if you curb your impatience you'll find you have a faster and more efficient vehicle.

A man who bought a new model of a popular make of car the first of this year has been running between my garage and the service station of the manufacturer ever since, because he drove it too hard when he first had it. The bearings, of course, were excessively tight, and when he drove at high speed, naturally the bearings became "starved" for oil. Eventually they gave way, the "stiffness" disappeared from the car and the owner went on his way happily. But his happiness was short-lived, for he has had nothing but trouble ever since. The bearings are pitted, and almost daily some new "defect" discloses itself.

These are only a few instances from thousands that have come under my attention of the harm done to cars and the unnecessary expense caused by the ignorance and carelessness of owners. Automobile engineering has advanced wonderfully since the days when a motor-trip, no matter how short, was a hazardous adventure, but engineers are not yet able to produce a car that is proof against flagrant misuse. They can and do produce cars, however, that ought to last a great deal longer and cost considerably less for upkeep.

Gas, oil, and grease, water for the cooling system, frequent inspection of the battery, the ignition system, and the tires and an occasional check up of the carburetor adjustment—if intelligent care is taken in these particulars, necessity for repairs is not likely to arise at all.

Balkite Battery Charger. Charges 6 volt "A" storage batteries.
Price $19.50
West of Rockies $20
In Canada $27.50

Balkite "B"—replaces "B" batteries and dry cells. Operates from light socket.
Price $55
In Canada $75

An unfailing power supply for both circuits

Here at last is an unfailing power supply for your radio set. Balkite Radio Power Units furnish constant uniform voltage to both "A" and "B" circuits and give your set greater clarity, power and distance. The Balkite Battery Charger keeps your "A" storage battery charged. Balkite "B" replaces "B" batteries entirely and furnishes plate current from the light socket. Both are based on the same principle, are entirely noiseless, and are guaranteed to give satisfaction. *Sold by leading radio dealers everywhere.*

FANSTEEL
Balkite *Radio Power Units*

BALKITE BATTERY CHARGER — BALKITE "B" PLATE CURRENT SUPPLY

Manufactured by FANSTEEL PRODUCTS CO., *Inc., North Chicago, Illinois*

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EAGLE AND MANY OTHERS
USE THORDARSONS!

Uniformity Guaranteed!

One reason that leading builders of fine sets use more Thordarsons than all competitive transformers combined is because Thordarsons run *absolutely alike, absolutely uniform;* always "match up" perfectly; always amplify *evenly* over the *entire* musical scale.

The following statement was made recently by a prominent set maker (name on request): "Any radio manufacturer who is sincerely desirous of producing an instrument of the volume necessary and of a tone superior to anything else on the market, must be absolutely forced to use Thordarson transformers sooner or later." Follow the lead of the leaders—build or replace with Thordarsons. They are unconditionally guaranteed. Any store can supply you. If dealer is sold out, order from us.

THORDARSON ELECTRIC MANUFACTURING CO.
Transformer Specialists since 1895
WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS
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Unconditionally Guaranteed
THORDARSON
Super
AMPLIFYING TRANSFORMERS
Standard on the majority of quality sets

TYPES AND PRICES: Thordarson "Super" Audio Frequency Transformers are now to be had in three ratios: 2:1, $5; 3½-1, $4; 6-1, $4.50. Thordarson Power Amplifying Transformers are $13 the pair. Thordarson Interstage Power Amplifying Transformer, $8. Write for latest Hook-up bulletins—free!

They say—

THEY SAY OF THE AUDIOLA "SUPER":
"Absolute elimination of distortion and foreign noises is attained . . . One stage of straight audio coupled with a stage of push-pull audio gives the volume of three audio stages with the clearness and distinctness of headset reproduction."
Audiola amplifies with Thordarsons!

THEY SAY OF THE OZARKA:
"Ordinarily a three step amplifier is noisy but we can guarantee the OZARKA to give the greatest volume possible with a tone reproduction that is satisfactory to everyone."
Ozarka amplifies with Thordarsons!

THEY SAY OF THE MASTER:
"The parts used are the best. Shielded, distortionless transformers insure perfect reproduction, unusual volume and tone."
Master amplifies with Thordarsons!

THEY SAY OF THE HARTMAN:
"The range, selectivity, volume, clarity and freedom from noises is remarkable."
Hartman amplifies with Thordarsons!

Look for the Checkered Box

Brass Plates—Soldered Joints—Grounded Rotor

Are Standard Features of the Bradleydenser

The Bradleydenser is a low-loss condenser with many distinctive features that insure long life and high efficiency. For instance, the brass stator and rotor plates are soldered at all joints. The plates cannot become loose, corrode at the joints or work out of alignment. The rotor is mounted on a long sleeve bearing that supports the rotor plates without the use of an outer end-plate. Therefore, the di-electric material is reduced to two small buttons. This means low loss and sharp tuning.

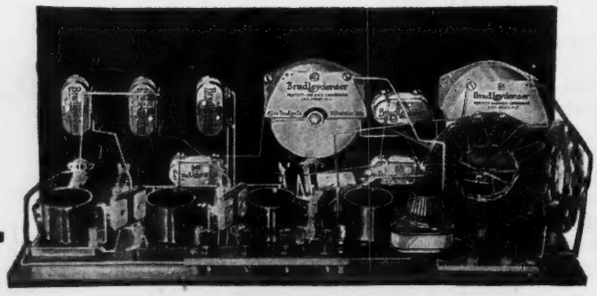
The stator plates are protected with a dust cap that can be detached without tools. The minimum capacity is extremely low, and body capacity effects are greatly reduced. The entire design makes for the highest efficiency in radio receivers.

Build for Efficiency

Allen-Bradley Co.
Electric Controlling Apparatus
293 Greenfield Ave. Milwaukee, Wis.

Use the Bradleydenser

This filter tuner with resistance-coupled audio amplifier is equipped with Bradleydensers. The tuning is sharp and selective.



Send for the latest information on the Bradleydenser. It will pay you to know about this remarkable low-loss condenser before planning your next radio set.

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ART COLOR PRINTING CO., NEW YORK